This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

WIDENER LIBRARY
HX HSYE E

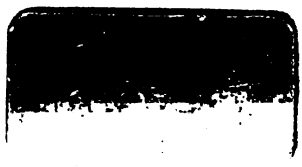
Sci 1636.24.2

Harvard College Library

FROM

The Albany Institute

19 Oct. 1830.



The Albany Institute

to the Library of Harvard

University Oct. 1830

Joseph Henry

Librarian

Rec'd Oct. 19 1830

TRANSACTIONS

OF THE

SOCIETY,

FOR THE

PROMOTION

OF

Agriculture, Arts and Manufactures,

INSTITUTED IN THE

STATE OF NEW-YORK.

VOLUME I.

THE SECOND EDITION REVISED.

ALBANY:

PRINTED BY CHARLES R. and GEORGE WEBSTER,

AT THEIR BOOKSTORE, IN THE WHITE-HOUSE,

CORNER OF STATE AND PEARL-STREETS.

1801.

798
32
~~40/2.73~~
Sci 1636.24.2

Officers of the Society,

FOR THE YEAR 1801.

ROBERT R. LIVINGSTON, L. L. D. PRESIDENT.

Hon. EZRA L'HOMMEDIEU, VICE-PRESIDENT.

SAMUEL L. MITCHELL, M.D.—F.R.S.E.
BENJAMIN DE WITT, M.D.—F.A.A.S. } SECRETARIES.

JOHN TAYLER, ESQ. TREASURER.

Hon. ROBERT R. LIVINGSTON,
Hon. JOHN LANSING, Jun.
Hon. STEPHEN VAN RENSSELAER,
SIMEON DE WITT, ESQ.
Rev. JOHN B. JOHNSON, } COMMITTEE OF PUBLICATION.

DISTRICT SECRETARIES.

Rev. *DAVID S. BOGART*, for the District of	Suffolk.
SAMUEL JONES, Esq.	Queens.
JOHN KEMP, L. L. D.	New-York.
GOVERNEUR MORRIS, Esq.	Westchester.
JOHN SUFFERN, Esq.	Rockland.
JOHANNES MILLER, Esq.	Orange.
Dr. *JAMES G. GRAHAM*,	Ulster.
SAMUEL BARD, M. D.	Dutchess.
JONATHAN EDWARDS, D. D.	Albany.
JOSIAH MASTERS, Esq.	Rensselaer.
JAMES GORDON, Esq.	Saratoga.
JAMES COCHRAN, Esq.	Montgomery.
JOHN METER, Esq.	Herkimer.
FRANCIS A. BLOODGOOD,	Oneida.
JACOB MORRIS, Esq.	Otsego.
EBENEZER FOOT, Esq.	Delaware.
NATHANIEL KING, Esq.	Chenange.
DAVID R. F. JONES, Esq.	Tioga.
JAMES GEDDES, Esq.	Onondaga.
JOSEPH ANNIN, Esq.	Cayuga.
CHARLES WILLIAMSON, Esq.	Steuben.
THOMAS MORRIS, Esq.	Ontario.

CONTENTS.

PART I.

Page.

RULES and Regulations of the Society, adopted in the year 1791, with the subsequent amendments and additions. - - - - - 1
Act incorporating the Society, passed 12th March, 1793. 5
Letter of the Agricultural Society to the Friends and Promoters of Rural Economy. - - - - 9
Oration, delivered by Doctor *S. L. Mitchell*, before the Agricultural Society, on the 10th of January, 1792. 15
Experiments and observation on Calcarious and Gypsious Earths, by Mr. Chancellor *Livingston*. - 34
Communications made to the Society, relative to Manures, by *Ezra L'Hommedieu*, Esq. - - 57
On the raising of Red Clover Seed, by *Ezra L'Hommedieu*, Esq. - - - - - - - - 67
Observations on the Hessian Fly, by *Jonathan N. Havens*, Esq. - - - - - - - - 71
Observations on the Drilling of Wheat, by *Walter Rutherford*, Esq. - - - - - - - 86
Respecting a plan of a Meteorological Chart, for exhibiting a comparative view of the Climates of North America, and the progress of Vegetation, by *Simeon De Witt*, M. A. P. S. - - - - 88
Tables of Theometrical Observations. - - - - 91

PART II.

Correspondence between the President of the Society, and President of the Chamber of Commerce, respecting the introduction of Plants and Animals from foreign places. - - - - - - - 93
Address to the Society, in consequence of their request, during the absence of Mr. Justice Hobart, who had been appointed to deliver the annual Oration, by *Robert R. Livingston*, Esq. President. - 99
Experiments and observation on Lucerne, by the Hon. *Robert R. Livingston*, President of the Corporation. 112
Extract of a letter from *Robert R. Livingston*, Esq. to William Livingston, Esq. Governor of New-Jersey, 1785, on the subject of Green-Gage Plumbs. 131
Experiments made by Manuring Land with Sea-Weed, taken directly from Creeks, and with Shells, by *Ezra L'Hommedieu*, Esq. - - - 133
On Ditches and Hedges, by *Ezra L'Hommedieu*, Esq. Vice-President of the Corporation. - - 135
On improving poor Lands, by sowing Red Clover Seed, by *Ezra L'Hommedieu*, Esq. Vice-President of the Corporation. - - - - - 139

Page.
On the Folding of Sheep, by *Ezra L'Hommedieu*, Esq. 139
On raising Calves, by *Ezra L'Hommedieu*, Esq. - 141
On the raising of Barley. - - - - - - 144
On the raising of Hops. - - - - - - 146
Essay on some Perennial Grasses; with the most approved method of Cultivation, and various references to their proper Soil, by *Peter De La Bigarre*, Esq. 152
On White Mulberry Hedges, by the same. - - 159
Letter from *Robert R. Livingston*, Esq. President of the Agricultural Society of New-York, to Arthur Young, Esq. - - - - - - 163
On the excretory Duct of the Feet of Sheep, by *Robert R. Livingston*, Esq. President of the Society. 168
On the effects of the Shade of Trees upon Vegetation, by *Robert R. Livingston*, Esq. - - - 169
On Cast-Iron Plough-Shares, by Col. *John Smith*. 173
Observations on constructing a Green-House, by *John W. Watkins*, Esq. - - - - - 174
Experiments on Wheat, Clover and Lucerne; submitted to the Society for promoting Agriculture and useful Arts, by *John Stevens*, of Hoboken. - - 176
On the Cultivation of the Tall-Meadow-Oats (avena elatior) for Pasture and Hay;—and on Gypsum and Stone-Coal as a Manure, by the Rev. *Henry Muhlenberg*. - - - - - - - 180
Review of William Curtis's Pamphlet on Grasses, by Dr. *Mitchell*. - - - - - - 182
On the decay of Apple Trees, by *William Denning*, Esq. 185
French and English Measures compared, by *Peter De La Bigarre*, Esq. - - - - - 187
A Treatise on Silk-Worms: In two parts. The first on their management within doors, and the second concerning their treatment in open air upon hedges, by *Peter De La Bigarre*, Esq. - - - - - 394

PART III.

Address delivered before the Society in the Assembly Chamber, in the City-Hall at New-York, the evening of November 8, 1796, by *James Kent*, Esq. - 191
Address to the Society, at their annual Meeting in the City of Albany, by Dr. *Mitchell*. - - 204
Experiments and observations on the culture of White Thorn for Hedges, by *Jonathan N. Havens*, Esq. 214
Observations on Manures, by *Ezra L'Hommedieu*, Esq. 231
On the feeding of Hogs to advantage, by *Ezra L'Hommedieu*, Esq. - - - - - - 242
On Septon (Azote) and its compounds, as they operate on Plants as food, and on Animals as poison, by Dr. *Mitchell*, in a letter to the Rev. Dr. Muhlenberg. 245

Page.

On the method of Tarring Seed Corn, to prevent its being deſtroyed when planted, by *James G. Graham*, Eſq. - - - - - - - - - 256

An account of extraordinary Crops of Corn, raiſed by means of Street Manure. - - - - - 258

Method of procuring new varieties of Potatoes, by *Simeon De Witt*. - - - - - 260

On raiſing Potatoes, by Mr. *Noah Webster*, in a letter to Secretary Mitchell. - - - 262

On the cultivation of the Poppy-Plant, and the method of procuring Opium &c. by Dr. *Ricketson*. - 264

On the Weaning of Calves, by *Lemuel Clift*, Eſq. 266

On the Onondaga Salt Springs, and Salt Manufactories in the State of New-York, by *Benjamin De Witt*, M. D. - - - - - 268

Reſult of Thermometrical Obſervations for the years 1795 and 1796, made at the City of Albany, by *Simeon De Witt*. - - - - - - 287

Reſult of Thermometrical Obſervations for the year 1797, made at the City of New-York, by *Gardner Baker*. - - - - - - 288

Thermometrical Obſervations, made on the North-Weſtern Lakes, from Auguſt 4, to September 4, 1797, by Major *C. Swan*. - - - - - 289

PART IV.

Addreſs delivered before the Society, in the Aſſembly chamber in the City-Hall, in the City of Albany, February 20, 1799, by *Simeon De Witt*, Surveyor-General. - - - - - - 291

On Vetches (Vicia Sativa vulgaris) and the benefit ariſing from the cultivation of them as a Summer Fallowing Crop, by *Robert R. Livingston*, L. L. D. Preſident of the Society. - - - - - 306

Obſervations on the Smut of Wheat, and the means of preventing it, by *Ezra L'Hommedieu*, Vice-Preſident of the Society. - - - - - 312

Obſervations on Cankerworms, and the means of preventing their effects, by *Samuel L. Mitchell*, M. D. Secretary of the Society. - - - - - 314

On preſerving and propagating Trees. - - - 321

An account of ſome of the Natural Productions of the Weſtern Part of this State; in a letter to the Secretary, by *John W. Watkins*, Eſq. - - - - 324

Means of preſerving Mildewed Wheat from injury, communicated by Mr. *L'Hommedieu*. - 328

Method of curing diſeaſes of Fruit-Trees, &c. communicated by the ſame. - - - - - 329

Thoughts on lime and Gypſum, by Chancellor *Livingston*, Preſident of the Society. - - - - 330

Page.

Obſervations on the Growth and Nouriſhment of Plants, by *Ezra L'Hommedieu*, Vice-Preſident of the Society. 335

On the effect of Oxygene, in accelerating the Germination of ſeeds, communicated in a letter to Simeon De Witt, Eſq. by *Robert R. Livingston*, Preſident. 340

On the effects of Nitre, or Salt-Petre, in promoting the Growth of Corn and Wheat, by *Robert Johnſon*, Eſq. - - - - - 342

On the advantages of Domeſticating the Elk and the Mooſe, by *Robert R. Livingston*, L. L. D. Preſident of the Society. - - - - 343

Improvements on the Steam Engine, communicated to the Society in January, 1798, by *R. R. Livingſton*, Eſq. and contained in a letter from him to Thomas Jefferſon, Eſq. - - - - 350

A new diſcovery relative to the art of manufacturing Paper; communicated in a letter to *S. De Witt*, Eſq. dated Clermont, September 8, 1799, by Chancellor *Livingston*, Preſident. - - - 354

Extract from a Repreſentation made to the Legiſlature at its preſent Seſſion, on the ſubject of Salted Beef, put up for Exportation. - - - 357

Calculation of the Profit to be derived from the groſs Matter or Sediment of Whale Oil; in a letter to the Secretary, from Mr. *Benjamin Folger*, dated Hudſon, November 29, 1792. - - 363

Method of Diſtilling Ardent Spirits from Potatoes, with obſervations; communicated by Mr. *L'Hommedieu*. - - - - - 364

Experimental Eſſay on the Properties of the Gallium Tinctorum, and its uſe in the art of Dying; ſuppoſed to be the ſame which the Indians uſe in Dying their Porcupine Quills of a red colour; in a letter to the Secretary, by *James Woodhouſe*, M. D. of Philadelphia. 367

An account of new conſtructed Fire-Places, by *John Stevens*, Eſq. in a letter to R. R. Livingſton, Preſident of the Society. - - - - - 371

Obſervations on the means of improving the Manufacture of Flour, and diminiſhing the conſumption of Water in Grinding, by *Robert R. Livingston*, Eſq. of Clermont. - - - - - 375

On the methods of introducing Heat into Rooms and preventing its eſcape; in a letter from *Simeon De Witt*, to Samuel L. Mitchell, M. D. - - 381

Obſervations on the manner in which Bot-Worms are generated in Horſes, and the means of prevention; in a letter from Chancellor *Livingston*, to Doctor B. De Witt, and from Major *Andrew Billings*, of Poughkeepſie, to Mr. Livingſton. - - 391

PART I.

INTRODUCTION.

At a Meeting of a reſpectable Number of Citizens, at the Senate-Chamber, in the City of New-York, for the Purpoſe of inſtituting a Society for the Promotion of Agriculture and Manufactures,

The Honorable EZRA L'HOMMEDIEU, Eſquire, in the Chair.

Reſolved, That Mr. Chancellor Livingſton, Mr. Simeon De Witt, and Mr. Samuel L. Mitchell, be a committee to prepare and report Rules and Regulations for the government of the Society.

At a Meeting of the Society in the Senate-Chamber, on Saturday the 26th day of February, 1791.

The Honorable JOHN SLOSS HOBART, Eſquire, in the Chair.

The Rules and Regulations reported by the committee having been read and conſidered, by paragraphs, were amended and agreed to, and are in the words following, viz.

Rules and Regulations of the Society for the advancement of Agriculture, Manufactures and Arts.

I. THE Officers of the Society ſhall conſiſt of a Preſident, Vice-Preſident, two Secretaries, and a Treaſurer.

II. The Society ſhall meet annually, at the place where the Legiſlature meets, on the Tueſday next

after the convening of both houſes; and continue by adjournments during the ſeſſion of the legiſlature.

III. The ſtated officers ſhall be elected on the firſt day of each annual meeting of the ſociety.

IV. No perſon ſhall be admitted as a member, unleſs he ſhall have been nominated at leaſt ſeven days previous to his election, and be elected by a majority of the members convened.

V. Every member on his admiſſion, ſhall pay to the treaſurer two dollars; and likewiſe one half of a dollar per annum, during his continuance as a member, to ſupport the funds of the ſociety.

VI. The objects of inveſtigation for the ſociety ſhall be *Agriculture*, *Manufactures* and *Arts*, with ſuch ſubjects of enquiry, as may tend to explain, or elucidate their principles.

VII. The ſociety ſhall parcel the ſtate into diſtricts, and elect at the annual election of officers, a ſecretary for each diſtrict, to reſide within the ſame, whoſe duty it ſhall be to convene the members of his diſtrict, to enquire into the ſtate of agriculture and manufactures within the ſame, to receive communications relative to the objects of the inſtitution, and to correct, arrange and tranſmit them to the preſident, to be laid before the ſociety.

VIII. The ſociety ſhall, once in every year, elect a committee, to be called *The Committee of Publications*, whoſe buſineſs it ſhall be to ſelect ſuch of the tranſactions of the ſociety as may merit publication, prepare them for the preſs, and from time to time publiſh the ſame.

IX. The elections of officers, members and committees, ſhall be by ballot, and a majority of the members preſent at a meeting, ſhall determine all queſtions.

X. Public notice ſhall be previouſly given, (by the Preſident, or in his abſence, by the next ſucceeding officer) of the chamber, and hour appointed for each annual meeting.

XI. If the preſiding officer or ſecretaries, be abſent from any meeting, the ſociety ſhall elect one to ſerve, pro hac vice.

XII. The funds of the ſociety ſhall be appropriated by the majority of the members preſent at regular meetings to the objects of the inſtitution, in ſuch a manner as ſhall be deemed moſt beneficial, and to no other purpoſe whatever.

XIII. Honorary members may be admitted in the manner preſcribed for the election of ordinary members, from among perſons not reſiding within this ſtate, whoſe talents and characters may add to the reſpectability and uſefulneſs of the ſociety.

XIV. No perſon elected as an ordinary member ſhall be entitled to the privileges of the ſociety, unleſs he ſhall have ſubſcribed theſe rules and regulations, and paid his arrears, if any are due, to the ſociety.

XV. Donations may be received by the treaſurer, to be added to the funds of the ſociety.

XVI. In order to prevent impoſition, the ſecretaries ſhall reject all doubtful and ſuſpicious facts, and to each article of intelligence tranſmitted to the ſociety, annex the name of the perſon offering it.

XVII. The ſociety ſhall be kept in order, by the rules which are obſerved for that purpoſe, by the Aſſembly of this ſtate.

The Members preſent then proceeded to ballot for their officers—when the following gentlemen were elected:

The Hon. ROBERT R. LIVINGSTON, Preſident.
The Hon. JOHN SLOSS HOBART, Vice-Preſident.
ALEXANDER M'COMB, Eſq. Treaſurer.
JOHN M'KESSON, Eſq. Secretary.

Society of Agriculture, Arts and Manufactures.
Senate-Chamber, Albany, 12th February, 1800.

The committee appointed to enquire if any and what alterations or additions may be requiſite in

the regulations and bye-laws of the ſociety, reported the following as a ſubſtitute for the 4th article of the exiſting rules—to wit :

Rule IV. No perſon ſhall be ballotted for as a member, unleſs he ſhall have been propoſed to the ſociety at leaſt ſeven days previouſly by two members, with an aſſurance that he is deſirous of becoming a member (excepting for honorary members this aſſurance ſhall not be neceſſary) ; and in every inſtance the name, place of abode and additions of the perſon thus recommended and ſigned by the propoſers, ſhall be delivered to the ſecretary in writing, read to the ſociety, and entered on the minutes —and if two thirds of the members preſent ſhall vote in his favor he ſhall be duly elected—And it ſhall be the duty of the ſecretary to inform every member of his election.

The report was accordingly agreed to without amendment, and adopted as a rule of the ſociety.

Extract from the minutes,

B. DE WITT, Secretary.

Society for the promotion of Agriculture, Arts and Manufactures.

State of New-York, 2d April, 1801.

WHEREAS it is enjoined by the 7th article of the rules and regulations, that " The ſociety ſhall " parcel the ſtate into diſtricts, and elect at the an- " nual election of officers, a ſecretary for each diſ- " trict, to reſide within the ſame, whoſe duty it ſhall " be to convene the members of his diſtrict, to en- " quire into the ſtate of agriculture and manufac- " tures within the ſame, to receive communications " relative to the objects of the inſtitution, and to " correct, arrange and tranſmit them to the Preſi- " dent, to be laid before the ſociety."—And whereas it is probable that much uſeful information, eſpecially on the ſubject of agriculture, may thus be collected from every part of the ſtate, and the obſerva-

tions and improvements of the ſociety more extenſively diſſeminated :—Therefore,

Reſolved, That the ſtate be divided, at preſent, into as many agricultural diſtricts as there are counties, and that each county as it now is, or may hereafter be eſtabliſhed by law, ſhall compoſe one diſtrict, until it may be thought expedient, in particular inſtances, to divide a county into two or more diſtricts, which may accordingly from time to time be done.

Reſolved, That theſe diſtricts ſhall be named after the counties of which they are compoſed, or if any particular county ſhall be hereafter divided into two or more diſtricts, they ſhall be named after the towns in which the ſecretaries at firſt appointed may reſide.

Reſolved, That in addition to the duties preſcribed to the diſtrict ſecretaries, by the exiſting "Rules and regulations," it ſhall further be their duty, to execute all ſuch orders and directions relating to the general objects of the inſtitution, as may from time to time be aſſigned to them by the ſociety.

Extract from the minutes,
BENJAMIN DE WITT, Sec'ry.

An Act to incorporate the Society inſtituted in the State of New-York, for the promotion of Agriculture, Arts and Manufactures.

Paſſed the 12th of March, 1793.

WHEREAS ſeveral perſons in the ſtate of New-York, have, by a voluntary agreement, aſſociated themſelves for the laudable purpoſe of promoting Agriculture, Arts and Manufactures in this ſtate.

And whereas, the ſaid ſociety have preſented a petition to the legiſlature, ſetting forth, that the petitioners conſidering that the wealth and proſperity of a country, very much depend upon the flouriſhing ſtate of its agriculture, arts and manufactures; and obſerving the benefit which in other countries have accrued from the inſtitution of ſocie-

ties, for the purpoſe of encouraging thoſe great objects, have voluntarily aſſociated themſelves, with a view of collecting from different parts of the ſtate, the different modes of agriculture that are in practice; to ſuggeſt ſuch improvements as may be found to be beneficial; to excite among their fellow citizens, a ſpirit of making experiments for the amelioration of lands which have been exhauſted, or in their natural ſtate are unproductive or unfit for cultivation; for increaſing the produce of ſuch articles as are propagated amongſt us, and promoting the culture of others which have been found uſeful in other parts, and for the improvement of field-huſbandry in general: and to introduce, as far as circumſtances may render proper, an emulation for the eſtabliſhment of uſeful arts and manufactures in thoſe parts of the ſtate, where they can be beneficially carried on! That the petitioners conceive it would greatly conduce to advance the important ends of their aſſociation, if they were authorized to act as a corporate body, and poſſeſs property to ſuch amount as would enable them to effectuate their purpoſes more ſatisfactorily to themſelves, and more beneficially to the public: They therefore prayed, that the legiſlature would be pleaſed by law to incorporate the ſociety for the purpoſes aforeſaid, under ſuch limitations and reſtrictions as to the legiſlature ſhall ſeem meet:—Therefore,

Be it enacted by the people of the ſtate of New-York, repreſented in ſenate and aſſembly, That Robert R. Livingſton, John Sloſs Hobart, Samuel L. Mitchell, John M'Keſſon, Matthew Clarkſon, Samuel Bard, John Cantine, Samuel Jones, Thomas Tillotſon, Joſeph Haſbrouck, James G. Graham, Jacobus Swartwout, Melancton Smith, Abraham Hardenburgh, John Gelſton, William W. Gilbert, David R. Floyd Jones, George Clinton, Aquilla Giles, Ezra L'Hommedieu, John Schenck, James Hunter, Egbert Benſon, John Blagge, John P. Delancey, Francis Childs,

John Watts, Peter Vandervoort, Henry Will, Ebenezer Purdy, Joſiah Ogden Hoffman, John Smith of Suffolk county, Cornelius J. Bogart, William Dunlap, Walter Rutherford, Philip Van Cortlandt, John Williams, Richard Varick, John Jay, Elias Newman, Amaſa Dingley, Gilbert Colden Willett, Stephen Luſh, John Stevens, John Kemp, Abraham Beach, Samuel Nicoll, Jonathan N. Havens, John L. Gardner, Frederick Rhinelander, Pierre De La Bigarre, Edward Livingſton, John Thurman, Jeremiah Van Renſſelaer, James Duane, Simeon De Witt, Nathaniel Sacket, William Rhinelander, Samuel Ruſſell, Moſes De Witt, David Frederick Laring, John Nicholſon, Andrew King, John Barber, Joſeph Barber, Johannis Miller, William Thompſon, David Ogden, John Delafield, Horatio Gates, Benjamin Strong, and Samuel Jones, junior, and ſuch other perſons as ſhall from time to time become members of the ſaid ſociety, ſhall be, and hereby are ordained, conſtituted, and declared, to be one body corporate and politic, in deed, fact, and name, by the name of *The Society for the promotion of Agriculture, Arts, and Manufactures*; and that by that name, they and their ſucceſſors, until the firſt day of May, one thouſand eight hundred and four, ſhall have ſucceſſion, and ſhall be perſons in law capable of ſuing and being ſued, pleading and being impleaded, anſwering and being anſwered, defending and being defended in all courts and places whatſoever, in all manner of actions, ſuits, complaints, matters and cauſes whatſoever: And that they and their ſucceſſors may have a common ſeal, and may change and alter the ſame at their pleaſure; and that they and their ſucceſſors, by the ſame name, ſhall be perſons capable in law, to purchaſe, take, receive, hold, and enjoy to them and their ſucceſſors, any real eſtate in fee ſimple, or for term of life or lives, or otherwiſe; and any goods, chattels, or perſonal eſtate, for the purpoſe of enabling them the

better to carry into execution, encourage and promote ſuch meaſures, as may tend to promote agriculture, arts, and manufactures in this ſtate."

Provided, The clear yearly value of ſuch real and perſonal eſtates, ſhall not exceed the ſum of eight hundred pounds, lawful money of New-York, and that they and their ſucceſſors ſhall have full power and authority, to give, grant, ſell, leaſe, demiſe and diſpoſe of the ſaid real and perſonal eſtates, or any part thereof, at their will and pleaſure; and that they and their ſucceſſors ſhall have power from time to time, to make, conſtitute, ordain and eſtabliſh, ſuch bye-laws, conſtitutions, ordinances and regulations, as they ſhall judge proper for the election of their officers; for the election or admiſſion of new members of the ſaid corporation, and the terms and manner of admiſſion; for the better government and regulation of their officers and members; for fixing the times and places of the meeting of the ſaid corporation; and for regulating all the affairs and buſineſs of the ſaid corporation.

Provided, That ſuch bye-laws and regulations ſhall not be repugnant to the conſtitution or laws of the United States, or of this ſtate. And for the better carrying on the buſineſs and affairs of the ſaid corporation, there ſhall be a Preſident, Vice-Preſident, Treaſurer and two Secretaries of the ſaid corporation, who ſhall hold their offices from the time of their appointment or election, until the ſecond Tueſday of January then next, and until others ſhall be choſen in their places. And that the ſaid Robert R. Livingſton, is hereby appointed Preſident; the ſaid John Sloſs Hobart, Vice-Preſident; the ſaid Samuel Jones, Treaſurer, and the ſaid Samuel L. Mitchell and Samuel Jones, junior, Secretaries of the ſaid corporation; and that their ſucceſſors in office ſhall hereafter be choſen by the members of the ſaid corporation, in ſuch manner and at ſuch times and places, as ſhall be directed by the bye-laws of the ſaid corporation

to be made for that purpoſe; and that the Preſident or Vice-Preſident, and any twelve or more of the members of the ſaid corporation, ſhall be ſufficient to conſtitute a legal meeting of the ſaid corporation.

And be it further enacted, That the members of the legiſlature, who ſhall not be ſtiled members of the ſaid corporation, be nevertheleſs in virtue of their ſtations, honorary members of the ſaid corporation and ſhall ſit but not vote as ſuch for officers, or have any voice in the diſpoſition of their funds.

Letter of the Agricultural Society to the Friends and Promoters of Rural Economy.

(CIRCULAR)

GENTLEMEN,

DURING the late ſeſſions of the legiſlature, a number of gentlemen, as well private citizens as members of the two houſes, aſſociated for the purpoſe of promoting, by their united labours, the progreſs of agriculture, arts and manufactures in this ſtate. It appeared evident to them, that by directing the attention of all claſſes of people to the obſervance of facts, and by inviting communications to the ſociety from every perſon who had the leiſure and capacity to make them, a valuable collection of knowledge would be obtained if each obſerver would contribute his mite. Nor was it leſs manifeſt, that works of mere ingenuity, eſſays upon ſpeculative and abſtract ſubjects, and performances intended to diſplay literature and erudition, came not within the ſcope of this inſtitution; its humbler, and as they believed, its more uſeful intention, is, to ſupply the wants and relieve the neceſſities of mankind, and thereby to *render human life more comfortable*; to multiply the productions of the land, to ſhorten or facilitate the toils of the labourer, and to excite a ſpirit of honeſt induſtry, whereby *riches may become more abundant*; and by inculcating the importance

of ordinary and common things, and of practical every-day truths—to ſtore *their underſtandings with ſolid knowledge;* ſo that happineſs, wealth and wiſdom, may keep pace with each other, and go hand in hand.

With a view of eſtabliſhing their inſtitution upon a broad baſis, and of conducting their buſineſs upon a liberal plan, the founders have taken into fellowſhip a number of reſpectable characters throughout the ſtate, from whoſe talents and diligence they have much to expect.

In order to make known the objects of the ſociety in a more particular manner, it was judged proper to cauſe certain queries to be printed and publiſhed, that the attention of their correſpondents might thereby be directed to ſuch matters as come within the compaſs of the inſtitution. It is not expected any correſpondent will undertake to anſwer the whole of the queſtions; but it is preſumed, that among thoſe which are hereunto annexed, every obſerver may find ſome adapted to his own ſituation and talents. Continually deſirous of procuring all ſorts of knowledge upon the ſubjects for which the aſſociation was formed, the ſociety would not wiſh to reſtrict the enquiries of their members or others to the articles enumerated, but would gladly receive communications upon every other matter included within the limits of their plan.

QUERIES.

1. *Manures.* Have you made any experiment upon Marl? Does your neighborhood furniſh either ſhell-marl or ſtone-marl? Has plaſter of Paris been introduced into uſe? What is it operations? Does it merely cauſe clover to grow, or is it ſerviceable to other graſſes, and to wheat and Indian corn? Is it as good as dung? Can it be in any caſe ſubſtituted for dung? Is lime very beneficial as a manure? In

what quantity, and on what ſoils, and for what plants is lime proper? Is quicklime as good as mild lime? Is not lime-ſtone when ſimply powdered as beneficial as when it is calcined! For what plants is aſhes particularly ſerviceable? Is leached aſhes leſs valuable as a manure than unleached? In what proportion? What is the beſt method of making and collecting manure in a farmer's yard?

2. *Soils.* Is the ſoil on which your experiments are made ſandy? or clayey? or is it loamy? Is it overſpread with ſtones, or interſperſed with rocks? What is the particular compoſition of it? Is there not a peculiar ſoil, beſt adapted by nature to each particular plant? How far can art proceed in mending nature's work by improving ſoils? What kinds of grain or graſs are found by experience to thrive beſt in any particular ſoil? What ſubſtances do you find in ſoils, unfriendly or hurtful to vegetable life? How can theſe be corrected, overcame or removed?

3. *Tillage.* To what depth ought land to be ploughed? Should the black mould only be turned up, or ought the yellow ſoil below, to be expoſed alſo? By what management in detail, are weeds and graſſes beſt deſtroyed in your fallow land? How is your land beſt made mellow for the reception of ſeed?

4. *Stock.* Is it good huſbandry to keep many horſes? Are not oxen much more ſerviceable and profitable? What is the comparative expence of a pair of horſes and a yoke of oxen? Have mules been bred by the people of your quarter? Would the breeding of mules be beneficial in this country? Do horſes draw beſt by collars or hames? Are oxen capable of doing moſt work when drawing by the horns or by the withers? How are ſheep beſt managed? What management is beſt adapted to make the wool fine and plentiful? How can the breed be improved? How the mutton made ſweet and ſavory?

Can any thing be gained by ſhearing lambs the firſt year? Might old ſheep be ſheared oftner than once a year? What are their diſorders? How can they be remedied or cured? Have you made any improvement in raiſing neat-cattle? Which is the cheapeſt method of rearing calves? In what manner and at what age is the beſt veal produced? How is the beſt beef made? By what particular management are cattle beſt prepared for the knife? How beſt kept for the pail? Which are the moſt approved methods of making and preſerving butter and cheeſe? What kinds of herbs or plants are unwholeſome or poiſonous to neat cattle? Do you know any facts concerning the venomous qualities of wild cherry-tree leaves? How are cattle beſt relieved when choaked by apples or potatoes, &c.? What is the cauſe of the horn diſtemper? How can it be avoided or removed? Have you any thing new and uſeful about ſwine? Which variety of the breed is moſt profitable? Would it be advantageous to introduce goats into this ſtate? What is the beſt plan of a poultry yard? Cannot wild ducks and teal, and heath-hens and wild turkies be tamed and domeſticated?

5. *Grain.* Which variety of wheat is moſt productive—the red, white, yellow, bearded or bald? In what proportion does winter wheat excel ſummer wheat? What occaſions wheat to blaſt? What turns it to ſmut? How does mildew happen? Can any or all of theſe be prevented? Can wheat turn to drips? How is wheat beſt preſerved between harveſt and threſhing time? between this laſt and grinding? In what ſoils and ſeaſons does rye flouriſh? What is the proper cultivation of oats? Why are the New-York oats ſo much lighter than the Britiſh or Canadian? Is barley well adapted to our ſoil and climate? Is it worth the while to enter largely into the culture of it? Is any part of our country adapted to the raiſing of rice? Can millet and ſpelts be cultivated with ſuc-

ceſs and advantage? What is the moſt approved method of raiſing a good crop of Indian corn? How is the ground beſt prepared for it? How ſhould it be manured? How weeded and tended? Can you give any information as to the raiſing of flax and hemp? How, and in what manner can the greateſt quantity of each be raiſed on an acre? of the fineſt quality? with the moſt ſeed? To what extent, and in what manner can peas and beans be cultivated.

6. *Graſſes.* What graſſes do you find to afford the beſt paſture? Which make the beſt hay? Have you any facts on the relative produce of ſpear-graſs, clover and timothy? Have you cultivated ſaint-foin, lucern and red-top? What are the reſpective good qualities of each of theſe? Cannot ſome of our indigenous graſſes be greatly improved by culture? Might not ſome exotics be imported from Europe? Which ſort of paſture agrees beſt with ſheep? neat-cattle? horſes? ſwine? What practical directions can you give on the ſubject of grazing?

7. *Fruit-Trees.* What kinds of apples afford the beſt cider? All facts reſpecting the grafting, inoculating, and planting of orchards will be acceptable. To what extent ought pear trees to be cultivated for the ſake of the fruit and the liquor to be obtained from it? The beſt method of cultivating peach, plumb, apricot, nectarine and cherry trees, will be uſeful information.

8. *Foreſt-Trees.* Do you know any facts concerning the propagation of the locuſt-tree? What can be done towards introducing the white mulberry tree? In parts of the country where wood grows ſcarce, would it be proper and profitable to raiſe in nurſeries, and tranſplant hickory, cheſnut, beech, aſh and other trees for fencing-ſtuff and fuel? Or would it be adviſable to make hedges of white thorn, prim, holly, yew, or other ſhrubs? And cultivate peat and turf for making fires?

9. *Vermin.* How are moles to be guarded againſt?

Will the palma chriſti drive them away? Is there any way of deſtroying grubs in your corn and flax? How can the bugs be deſtroyed which eat up your cucumber, melon and pumpkin vines? Is there any way of preventing the ravages of the wheat inſect? Is this a new ſpecies of animal? Is it peculiar to the United States? Or whence came it? What is the eaſieſt way of deſtroying canker-worms and catterpillars in orchards? Do you know how the lice or flies that infeſt cabbages and turnips can be overcome?

10. Have you any improvements in the management of bees? Can the ſilk-worm be profitably introduced into your neighborhood? Are there not ſome American phalœnas which might afford good ſilk? What are they? And on what plants do they feed?

11. *Manufactures.* What is the beſt method of making ſoal leather? Are there any other barks than oak, hemlock and birch fit for tanning? Do you know the method of ſplitting hides for book-binding, parchment, &c.? Have any improvements been made in the manufacture of ſteel? Do you know of any new material for the making of paper? Which is the moſt advantageous way of making pot-aſh? Are there not ſome ochres, the produce of our country, proper for paints? What progreſs has been made in procuring oil from lint, palma chriſti, and ſun flower ſeeds? Can you ſuggeſt any thing capable of raiſing the reputation of our flour in foreign markets? Do you know of any beds of nitre, allum, vitriol, or ſea-ſalt? Are there any coal-mines? Can you ſuggeſt any plan of improving our wool ſo as to render it more fit for ſuperfine fabrics? What can be done toward the manufacture of cotton? Where are we to find, and how collect and work up the materials of glaſs, china and earthen-ware?

TRANSACTIONS, &c.

Oration, delivered by Doctor S. L. MITCHELL, *before the Agricultural Society of New-York, on the* 10*th of January*, 1792.

Mr. Preſident,

and Gentlemen of the Agricultural Society,

SINCE you firſt did me the honor of appointing me to deliver you an Oration, I have been ſeveral times ready to relinquiſh the undertaking, thro' an apprehenſion that I ſhould fail to do tolerable juſtice to the ſubject, and ſhould tire your patience without even amuſing your imaginations. For I know that on occaſions like this, more ingenuity and ſprightlineſs of thought, and more of the poliſh and ornament of diction are expected to embelliſh the phraſes and ſentences of the ſpeaker, than on common occaſions; and therefore felt, as I judged, a well-grounded fearfulneſs, leſt ſomewhat of bluntneſs in ſentiment, and plainneſs in expreſſion, might ſound rather harſh or uncouth to the nice ears of my audience. Bear with me then, while I expreſs my meaning in my own way, without declaiming in the elegant copiouſneſs of *Pliny*, or the ſubtil erudition of *Eraſmus*. Withdraw your minds a little while from public cares, and by way of relaxation from the greater concerns of politics, juriſprudence and legiſlation, ſuffer them to be conducted by me to the contemplation of agriculture and rural affairs.

Fortunately it happens, that no violent effort is neceſſary, either on your part or on mine, to fix and confine attention to the theme, ſince there is a natural propenſity in the human mind to be pleaſed with the ſcenery and proſpects of the country. When all the pomp and luxuries of high life have palled upon the ſenſes, then the jaded minds of the cits are refreſhed by ideas of breezes and trees, of vallies and brooks, of ſhepherds and their flocks. Thus in the palace of *Ptolemy* could *Theocritus* charm the courtiers with his rural lays, ſo did the *ſwain of Mantua* delight the minions of *Auguſtus* with the dialogues of *Melibœus* and *Tityrus*, of *Menalcas* and *Palemon*. In like manner, in latter days, have *Geſſner* and *Haller* pleaſed the taſte of the Germans with their paſtoral eſſays, as much as *Pope* and *Philips* have gratified that of the Engliſh. The imagination loves to range without controul in this romantic variety of productions; and according to the humour and inclination of the deſcriber, a country retreat becomes an *Elyſium* or a *Bœtica*, an *Arcadia* or a *Paradiſe*.

It would be unneceſſary to cite from doubtful antiquity, the ſtory of the goddeſs *Ceres*, who is ſaid to have travelled over the world with her Cornucopiæ, to preſent bread-corn to mankind, and inſtruct them in the art of cultivating it; and it would be equally uſeleſs to quote from the ſame fabulous authorities, any particular accounts of the divinities, *Priapus*, *Flora* and *Pomona*, who were thought to preſide over gardens, flowers and orchards. The rays of right reaſon have diſſipated the darkneſs of theſe ſuperſtitions, and ſhewn us that next to the providential bleſſings of a good ſeaſon, the huſbandman, truſting to the laws of his country for ſecurity, depends, under their joint influence, upon his own labor, induſtry and vigilance for the various and plentiful produce of the year.

For among the numberleſs favours which Divine bounty has beſtowed upon this fortunate land, that

which in the firſt place claims our grateful acknowledgments, is the abundant harveſt which rewards the induſtry of the farmer: ſince to a healthy climate and a fruitful ſoil, there is annually added the genial influence of a ſeaſon, that beautifies ſpring with bloſſoms, and loads autumn with fruit.

But neither the fertility of the land, nor the wholeſomeneſs of the ſituation, nor the favorableneſs of the weather, would properly encourage agricultural exertions if the temper of our laws did not ſecond the attempts of the labourer, by encouraging the *ſickle* and honoring the *plough*.

By the wiſe policy of our legiſlature, the ſhackles of feudal bondage have been knocked off, and our citizens, who feel nothing of vaſſalage or ſervitude, act with the ſpirit of freemen. The abrogation of the laws of entails and of primogeniture, has had the moſt happy effect in rendering eaſy the diviſion and alienation of real property, whereby the natural right of every man to a certain part of the earth's ſurface, which in former times had been violently and unjuſtly wreſted from the greateſt part of thoſe who had advanced much above barbaric rudeneſs, is reſtored, and with it that mediocrity of condition which hears with honeſt indignation the "monſtrous faith of *many* made for *one*." The allodial and ſocage tenures of our lands, by giving free ſcope to purchaſers, and undivided profit to cultivators, have paved the way to more virtue and happineſs than all the mines of Peru and Mexico ever have afforded.

And even with all theſe advantages, how deſolate, how proſtrate is a country until improved by the hand of induſtry! Turn your eyes to the United States and behold its achievements: Three centuries are ſcarcely paſt ſince theſe regions were diſcovered, till then unknown to the more civilized part of the world. Some tribes of ſavages were here and there ſcattered over the country, whoſe ſubſiſtence was principally derived from the chace. Their chief

dependence was on the precarious product of fiſhing and hunting. Their agriculture did not conſiſt of much more than the cultivation of a little pulſe and maize. As the wild animals upon which they fed multiply infinitely more ſlow than tame ones, it neceſſarily followed, that in ſuch a ſtate of ſociety, a very large tract of country was neceſſary for the maintenance of a very few inhabitants. Rude men and wild beaſts roamed in ſcanty number through the pathleſs wilderneſs, and poſſeſſed a wider range of commonage than according to juſt diſtribution they were entitled to. At that time murmuring and diſcontent aroſe in the hives of Europe, and ſwarms of emigrants flew weſtward and colonized along theſe coaſts. The new-comers claimed, under *nature's univerſal charter*, a part of that land which the natives poſſeſſed excluſively in too great a proportion. Their ſettlements grew, their population increaſed, and oh! that any acts of cruelty and oppreſſion have been committed to tarniſh the ſplendour of their works. Ancient oaks and pines fell beneath the ſtrokes of the axe, ravenous wolves and tigers forſook their abodes, and in the midſt of a deſert waſte and wild, the hardy adventurers ſcooped out a dwelling-place. Where lately briars and nettles deformed the ſpot, the conſuming operation of fire prepared the earth for the reception of wheat and rice. Tobacco and indigo, laying aſide their wildneſs, put on a domeſticated look. Orchards of apples, pears and peaches ſprung up where not long ſince the toxicodendron emitted its poiſonous vapours. The horſe, the cow, the ſwine and the ſheep ſucceeded the deſtructive beaſts of the foreſt; and where the ſavage hornet formerly took his dreary flights, the honey-bee, over meadows of blooming clover, collects her ſweets: I ſee the ſettlers in their progreſs from the Atlantic coaſts, collect the peltry and lumber of the woods into vaſt magazines; I ſee them hew out roads, drain ſwamps, build bridges and conſtruct mills; I ſee

them climb up the ſide of the Apalachian mountain, and paſſing that formidable ridge, eſtabliſh themſelves on both ſides of the Ohio; I ſee the wilderneſs every where as they go, changing to a civilized country, and ſmiling with plenty, even beyond the Miſſiſippi. Such are the enterprizing labours of thy citizens, oh! America.

Salve magna parens frugum!
Magna virûm.——

Such are the wonder-working effects of induſtry, although its operations were cramped in the beginning, by the ſelfiſh policy of Britain, and afterwards interrupted by the unnatural war which for ſeven long years ſhe waged with the people of this land. Even then, while green in the griſtle of youth, and not yet hardened in the bone of manhood, Columbia's ſons, as induſtrious in defending as in aſſerting their rights, told the tyrants "they wiſhed to be free," and as the mild language of petition and remonſtrance was treated by him with contempt and diſdain, they in a voice that ſtruck with terror and diſmay both himſelf and his hoſt, replied to him as an *argumentum crucis*, the ultima ratio of nations, and from the cannon's mouth thundered the unwelcome truth in his ears.

Hitherto, the American huſbandman has cultivated a ſoil, enriched for ages by the yearly addition of a freſh ſtratum of mould. From the firſt exiſtence of vegetation upon the dry land, decayed plants have continually furniſhed a ſupply of manure, which the winds and rain have liberally ſpread abroad. As the ſupply was annually greater than the conſumption, the earth, unexhauſted by its productions, increaſed in fertility. The thick layer of vegetable mould which covered the face of the earth was a ſtore-houſe of food for plants, and this quantity was greatly increaſed by the converſion of wood into aſhes by clearing. It is not wonderful then, that for ſome years newly-cleared ſettlements ſhould abound in

produce, and require little more labor than that of ploughing and reaping; for during this period the proviſion is waſting, which for centuries had been accumulating. But the time will come, and indeed in many places now is, when the land, repeatedly wounded by the plough-ſhare, and exhauſted of its richneſs, ſhall be too weak, of itſelf, to make plants grow with their former luxuriance. This may be called the æra of ſyſtematic agriculture, when man, taking the earth from nature's hand, bare of manure, is ſo to manage and diſpoſe it artificially, that it ſhall yield him firſt a ſubſiſtence, and then an overplus to grow wealthy upon. How far art may go in this ſpecies of improvement is yet unknown, as the *ultimatum of fertility* has never yet been reached. As far as experiments have been made, we find the earth liberally affording its produce, in proportion to the labour and ſkill beſtowed in its tillage; and as the ingenuity and invention of man may increaſe to an unknown and inconſiderable degree, ſo may the improvements and arrangements of huſbandry keep pace therewith, until the moſt fruitful ſpot that now exiſts, may produce a tenfold quantity, and the land which now ſupports an hundred men, give equal enjoyment to a thouſand. Recollect, for inſtance, what agriculture has done in two countries, naturally very unfavorable to it, Switzerland and Scotland; compare their preſent populouſneſs and happineſs, with what they formerly were in Cæſar's time; calculate whether theſe countries are not, by the well-applied induſtry of their inhabitants, as different from ancient *Helvetia* and *Caledonia*, as *Ireland* is ſuperior to *Labrador*, or *New-York* to *Terra del Fuego*.

Columella relates a ſtory finely illuſtrative of the excellence of good tillage:——De re Ruſtic. L. iv. c. 3.—"Græcinus in his book concerning vines, "relates that he had often heard his father tell of a "certain Paridius who had two daughters, and a

"farm planted with vines. Of this farm he gave "one third part, as a marriage portion, to the man "who wedded his elder daughter, and notwithſtand- "ing, received as much produce as before, from the "two thirds which he reſerved to himſelf. After- "wards on the marriage of the younger daughter, "he gave away the half of the remaining land, and "found his income ſtill in no reſpect diminiſhed. "What concludes he from this? But that the *third* "*part* of the farm was at length better cultivated "than *the whole* uſed to be before."

But in this ſtage of farming, a well managed plantation muſt be carried on with ſteadier labour and more exact ſkill than in the former. For now when timber becomes ſcarce, fences are more difficult to be kept in repair; where the ground is not of itſelf productive enough, manure muſt be procured; if a farmer's own ſtrength is not ſufficient to carry on his buſineſs, a number of additional laborers are now neceſſary. In order to perform this requiſite labor, two ſorts of workers have been employed, hired freemen and ſlaves. Upon calculations and eſtimates fairly made, it appears that the profits of plantations muſt be enormous to ſupport the expence of a ſlave-cultivation. The income of a rice, an indigo, a ſugar or a tobacco eſtate, has been great enough in the newly-cultivated lands of ſome of the ſouthern ſtates and Weſt-India iſlands, to admit of this mode of management. But at preſent the profits ſeem not ſo prodigious as they have heretofore been. The dearneſs of Weſt-India ſugars, the prohibition of new importations of ſlaves in ſome places, and the introduction of the plough in the ſtead of the hoe, all indicate the decline of ſlavery, and all prove it to be leſs and leſs the true intereſt of the planters to conduct their buſineſs in the old way. Where the produce of a farm is bread-corn, flax, hemp, graſs and live-ſtock, the profits are moderate, and the labor of free men, is generally preferred, as moſt conſiſtent

with good economy: accordingly, in the northern ſtates, ſlavery is entirely aboliſhed. It appears from the great depreciation and frequent manumiſſions of ſlaves in this ſtate, that our fellow-citizens are becoming covinced of the ſame truth by experience. Upon taking a ſurvey of the ſlave-holders with whom I am acquainted, I find thoſe who have the greateſt numbers, to be men of conſiderable hereditary eſtates in land, or of a handſome capital acquired by marriage or bequeſt, but I cannot name an inſtance of a man of ſmall property, ever getting rich upon the profits of ſlave-labor. Therefore the kitchen eſtabliſhments of thoſe who keep fifteen or twenty negroes, are not to be conſidered as matters of revenue, but of expence, juſt after the manner of a ſtud of ſupernumerary horſes, kept either to indulge the pride or gratify the prejudice of their owner. It is to a conviction of the impolicy and expenſiveneſs of this kind of ſervice, rather than to any moral or religious conſiderations on the ſubject, that the decline of ſlavery is principally to be attributed.

But I would not wiſh to be underſtood that the whole of our labor ſhould be applied to agricultural purſuits, as if thoſe were, as ſome argue, the only induſtry that is productive; for I think it may be clearly proved, that the capital and labor of this country, will be moſt advantageouſly employed, if a part of it is expended in manufactures; the beſt policy in this reſpect, being to carry on agriculture without neglecting manufactures, and at the ſame time ſo to manage manufactures, as that agriculture may be conducted with a due degree of ſpirit. That accumulation of monied capital which is ſo rapidly making in the United States, beyond the amount neceſſary to carry on the agricultural and commercial buſineſs thereof, is a moſt favorable prelude to the eſtabliſhment of domeſtic manufactures, to which the preſent ſpirit of ſpeculation and enterprize of our citizens, ſeems peculiarly favorable.

But how are fields to be artificially fertilized? By manure. This is the great hinge upon which the whole ſyſtem of agriculture turns. In procuring this needful ſubſtance, we are firſt to imitate nature in collecting all the vegetable matter we can find, ſuffering nothing to be loſt. As, however, if a field, yielding graſs for brutes, or grain for man, is principally exhauſted of its produce by the creatures whom it ſupports, a very inconſiderable quantity remains for manure. What then is to be done? muſt the land go on to be impoveriſhed from year to year? No. The animal, the vegetable and the mineral kingdom muſt be ranſacked for ſomething to aid the growth of plants. The aſhes of wood and of peat, the muddy depoſitions of puddles and ponds, the unreſpirable portion of our atmoſphere, and ſome of the particles floating therein; the various earthly productions of marle, chalk, gypſum, clay and lime, and likewiſe the excrementitious matters of moſt animals, are found by experience, when properly employed, to promote directly or indirectly the proceſs of vegetation. When theſe things are added to the ſoil, they act in one of theſe ways: 1ſt. They are a pabulum plantarum, and materially contribute to the nutriment of plants; or 2dly, They are a ſtimuli to plants, and by exciting them to action, cauſe a greater abſorption of food, a better aſſimilation of it, and conſequently a more rapid and vigorous growth; or 3dly, They ſo alter and diſpoſe the earth in which plants are rooted, that the radicles ſhoot more eaſily and more extenſively through it, or in other words, it becomes a better filter for ſtraining and applying nouriſhment to their inhaling or abſorbing veſſels. Here, however, it is neceſſary for me to pauſe; for in order to decide in which of theſe ways manure operates, it would be neceſſary to take into conſideration a much greater aſſemblage of facts than the limits of this attempt permit; and as the ſolution of theſe queſtions involves the intricate diſcuſſion of

what the food of plants is, whether water, inflammable air, phlogiſton or attenuated earth, it ſeems rather too important for diſcuſſion in this conciſe eſſay.

Quicklime has been recommended as a manure, which by corroding, diſſolving and deſtroying the vegetable matter lying about the land, on which it is ſpread, would by its ſeptic quality add to the fertility of the ſoil. It is doubtful whether quicklime, as ſuch, ever does any good; certainly it has done hurt. But let its primary operation be as it may, it ſoon returns to the condition of inert earth by combining in its expoſed ſtate with ærial acid. Lime then is to be conſidered in manuring, merely as calcareous earth in powder, and not as having undergone in the kiln, any change ſave pulverization. The alteration made in the ſoil by its application is ſimply in the addition of a new ſubſtance to its former ingredients, which may change the filtrating power of the earth, but not apply a freſh ſtimulus to the growing plants. Calcareous earth of any kind, reduced to powder in any way, if of equal purity and fineneſs, ſeems equally adapted to the purpoſes of manuring.

The plaiſter of Paris, which has been ſo much extolled by the Pennſylvanians, fails egregiouſly in our trials upon Long-Iſland. There is ſomething ſingular in its failure to do good almoſt every where in the maritime parts of this ſtate. It falls ſhort of the character given to it in almoſt every reſpect. This, I believe, is partly owing to the deception of the buyers, in purchaſing both *marle* and *gypſum*, in a powdery form, under the name of plaiſter of Paris. In ſome meaſure alſo it is to be aſcribed to the hyperbolical praiſes uſually beſtowed upon new diſcoveries and projects. From my own experiments, I have little to ſay in its favor. Once, indeed, it did ſeem to make the clover of my meadow a little more thriſty; but the next year, the very ſpot ſo manured with the plaiſter, yielded no better Indian corn than any thereabouts, tho naturally not more barren.

Along the ſea ſhores on the banks of rivers, where *fiſh* are plentiful, they afford a valuable manure. Some ſorts of theſe, which are but indifferent food, may be advantageouſly uſed to increaſe the fertility of land. They aid vegetation by ſtimulating the roots of plants. It is not eaſy to ſay how extenſively farms conveniently ſituated may be improved, by a proper uſe of the innumerable ſhoals of theſe creatures which in great variety viſit our coaſts.

Wheat, which is one of our ſtaple articles, ought to engage a primary degree of attention. Great complaints are made in foreign places of the foul condition of the grain, and the bad quality of the flour which we export. In as much as we value the goodneſs of our commodities and our credit as a commercial people, we ought immediately to ſtop the growth, yea, hinder the continuance of this evil. The chamber of commerce of New-York, ſometime ago publiſhed ſome ſeaſonable and judicious remarks on the purification of wheat offered for ſale. Cockle, drips and ſorrel often mingle their ſeeds with the crop, and by the careleſſneſs of the farmer, the mixture of them all is brought to market for wheat. This adulteration, though it lowers the price, is however pretty well corrected by the rolling-ſcreen. But the worſt vitiation that befalls the wheat-harveſt is the commixture of *rye*. No machine has yet been found capable of effectually ſeparating them, and from the nearneſs of ſize in the two ſorts of grain, it is not likely that ſuch an one can be contrived. The method of remedying this inconvenience radically, is to remove all traſh from the fallow-field, to ſow nothing but the pure ſeed you wiſh to grow, and if, after theſe two precautions, any foulneſs ſhould appear, to tear up or cut off the intruding plants. Thus by a little additional care of the farmer, may purity be reſtored to our harveſts, and reputation to our markets.

The ſugar of the maple-tree has become an article of ſome conſiderable importance. It is probable, for ſeveral reaſons, its value will encreaſe. Firſtly, The new lands of the Weſt-Indian cane-iſlands are wearing out, and as the ſlave-cultivation, which is the moſt expenſive of any, ſtill continues there, the product and profit of the plantations muſt certainly diminiſh. Secondly, The demand for ſugar is greater than ever, on account of the encreaſing population of ſeveral countries which conſume it, as the United States and Canada, for example. Thirdly, Among people who have been for a long time conſumers of ſugar, faſhion and habit have rendered them more extravagant in the uſe of it. Fourthly, The duty impoſed upon foreign ſugar by the act of Congreſs adds to its dearneſs. As therefore there can be little expectation of the cheapening of foreign ſugar, but rather when we conſider the inſurrections and diſorders in ſome of the principal iſlands, we ſhould apprehend the price may ſtill go on to riſe, there is a well-grounded conjecture that our domeſtic ſugar manufacture may be highly beneficial to the ſtate; eſpecially ſince it cannot only be granulated in the moſt beautiful brown form, but can be refined and whitened into loaves of the firſt quality. How far it might be poſſible or proper to carry into effect the project of planting orchards of maple-trees, may be well worth the ſociety's attention.

The locuſt-tree (Robinia Pſeudacacia) is one of the moſt valuable trees now cultivated. They grow beſt in warm ſandy land, and become fit for timber in about twenty-five or thirty years. They do not grow bulky enough for ſawing into boards, or hewing into beams for large buildings; but their greateſt uſe is for ſhip-trunnels, fence-poſts, mill-cogs and fire-wood. A well-grown tree is worth to the proprietor as it ſtands, four dollars; this when cut, ſawed and ſplit, can be made into one thouſand trun-

nels, which may be ſold for ſeven dollars and a half in a ſhip-carpenter's yard. Or if mill-cogs be formed of it, they endure long friction before they wear out. Or if worked into poſts to be ſet into the ground for garden-fences and other handſome incloſures, they are ſuperior in point of durability to almoſt any known wood; for ſome which have been examined after twenty years expoſure to the weather, without paint, appeared to be as little impaired as if they had been recently planted, and it is ſaid they will laſt in a ſound and good condition fifty or ſixty years, and even longer: and for theſe ſeveral purpoſes they equal or excel mulberry. If uſed for fuel, it makes a fire as hot, briſk and comfortable as kickory. The locuſt is ornamental as a flowering tree, as well as uſeful for timber. The bloſſoms which are of the papalionaceous kind, unfold in the end of May or the beginning of June, and hang down in beautiful white cluſters to the number of twenty or thirty ſingle ones upon a foot ſtalk, perfuming the air to a conſiderable diſtance with their ſweet and fragrant odour. It is ſo eaſily cultivated, that on Long-Iſland one often ſees large pieces of land entirely overgrown with artificial woods of theſe trees. As our commerce and manufactures improve, the demand for this valuable timber will increaſe, and more eſpecially on account of the approaching ſcarcity of wood in the neighborhood of the capital of the ſtate. Therefore it ſhould be recommended to all farmers on whoſe lands locuſt-trees will grow, to begin immediately the cultivation of them, as well for the profit as the ornament to be thence derived; and they may be aſſured that in a ſuitable ſoil and climate, ſucceſs will attend their endeavors, ſince no extraordinary ſkill nor expence is required in the management of them.

Some attempts have been made to propagate the vine among us by gentlemen who ſeemed anxious for its general introduction and culture. They have

procured from ſome of the ſouthern countries of Europe cuttings of the moſt choice vines, hoping that after growing in our climate, they would retain the flavour peculiar to the grapes in their former ſoil. I do not know that much ſucceſs has followed theſe attempts, except in ſmall experiments in gardens and on fruit-walls. I am doubtful what to ſay concerning the eſtabliſhment of vineyards among us. I fear the weather is too variable, and the winters too cold to allow the ſouthern vines to thrive. Yet, in tracing the vine from Aſia, where it firſt grew, we find it planted in ſucceſſion on the iſlands of the Archipelago and the ſhores of the Mediterranean ſea, until the time of the Emperor Probus, who permitted the planting of it in Ciſalpine Gaul, where it had been forbidden before by Domitian and his predeceſſors, whence it was carried north of the Alps to regions formerly believed to be too unhoſpitable for its growth. It has ſince by degrees become naturalized to the countries where it now lives. It is true that ſeveral learned men have entertained an idea that the climates of France and Germany have become more mild than anciently they were, and there are many well authenticated facts in hiſtory to corroborate the opinion. Still, ſomething perhaps may be done by domeſticating our indigenous vines, of which there are ſeveral ſorts, and meliorating them by kind cultivation; or if European ſhoots muſt be ſent for, they ſhould be brought from the northern provinces of France, or the weſtern dominions of Germany, whoſe climates more nearly reſemble our own.

The white-mulberry tree is already growing in our ſtate, and is ſaid to be cultivated to conſiderable extent in Connecticut. The legiſlature of New-York, during the laſt ſeſſions, were liberal enough to offer a reward to the ſucceſsful propagator of them. There is therefore little need of expatiating on a ſubject already recommended by its own utility, and by legiſlative ſanction. I ſhall only remark, the

trees are afforded to purchaſers at ſo low a price, and the ſilk-worms can be fed and attended at ſo little expence, that there ſeems ſufficient inducement to undertake the buſineſs, even without the incentive of the bounty.

The mangel-wurtzel, or root of ſcarcity, ſeems not to have ſucceeded among us in a degree equal to the character given of it by the French and Engliſh writers. It is therefore doubtful whether we ſhall ever be much benefitted by the introduction of this plant. It is to be wiſhed, however, that a plant of which ſo much has been favorably ſaid, may not be abandoned without full and convincing experiments of its inutility in American huſbandry.

Much greater profit may be expected from the potatoe, which ſeems better adapted to our climate, and has been greatly improved within thirty years. It ought to be particularly attended to in planting them, that the cuttings be made from thoſe of the largeſt ſize, or rather that whole ones, without any diviſion whatever, be planted to raiſe a crop from. I mention this the more particularly, becauſe it is too common a cuſtom to allot the largeſt roots to the kitchen, and reſerve the ſmaller ones for the field. It is ſurpriſing what difference there is between the ſize, vigour and produce of little potatoes and big ones, planted in the ſame ſoil and tended with equal care. I am convinced that by the injudicious planting of the ſmaller ones laſt ſeaſon, my potatoes did not yield me half ſo many buſhels as they would have done, had very great ones been committed to the earth in their ſtead. Some experiments made not long ago in England and Nova-Scotia, ſet the difference in favor of large ones in a ſtrong light.

It cannot have eſcaped your obſervation, gentlemen, how backward we are in raiſing of barley. The extenſive and numerous breweries of New-York, and other parts of the ſtate, are but partially furniſhed with the material of malting from our own

produce. It is undoubtedly a ſubject of ſerious regret, that while our farmers exhauſt the ſtrength of their fields by impoveriſhing crops of oats, they neglect the more profitable culture of barley, and thereby neceſſitate the brewers to import their grain from the neighboring ſtates, or from foreign parts, or drive our citizens to the leſs wholeſome and more expenſive uſe of diſtilled ſpirits. The practice of raiſing barley is to be conſidered more lucrative to the farmer, as being a better employment of his labor and capital, and likewiſe more advantageous to the ſtate by preſerving the morals and induſtry of its people from the injurious effects of rum and other ardent liquors.

Nearly connected with this is the raiſing of hops. The emolument derived from hop-yards to the owners of Kentiſh eſtates, may ſerve as encouragement to the American huſbandman. This plant grows ſpontaneouſly in our ſtate, and undoubtedly could be highly improved by care and management. That proper attention ſhould be paid to it is to be wiſhed, not merely for the ſake of its flowers as an ingredient in brewing, but that proper experiments ſhould be made on its rind, to know whether it might not be prepared in a form ſuitable for cordage, or ſome ſuch manufacture. Much remains yet to be done in finding out and preparing the fibrous parts of plants.

This leads to the conſideration of hemp, of which large quantities are imported. It is certainly a pity, in a country like ours, the cultivation of this uſeful plant is ſo much neglected.

Some obſervations remain to be made on ſeveral animals, both uſeful and noxious to farmers. Though all remarks on the breed of dogs and horſes may be conveniently ſpared, ſince pains enough is already taken among us to rear them in all their varieties, except that as to the former, ſince conſiderable ſlaughter of ſheep is made by them from time to time, ſome better mode of training them for buſineſs ought to be practiſed.

The bos bubalis, or tamed buffaloe of Europe, ought to be introduced as a uſeful beaſt for the draught. He has been long domeſticated in Hungary and Tranſylvania, and has been lately carried into the ſouth of France. His paſſage to the United States might be readily effected, in one of the ſhips trading to the Mediterranean. His ſtrength is ſaid to be great, his temper docile, his ſtature large; the hide thick, meat good, and milk ſavoury.

Perhaps a conſiderable ſaving might be made in the annual expence of a farm, by the ſubſtitution of mules inſtead of horſes. Theſe creatures live upon leſs and coarſer food than horſes, bear more drudgery and hardſhip, and live to a greater age. What but an ignorance of the laborious ſervice they are capable of undergoing, hinders the breeding of them?

The rejection of the labor of oxen, and the employment of that voracious and expenſive animal the horſe, is in too many places, a matter of ſerious regret. To carry on the work of a great plantation by horſe-labor, without the aſſiſtance of oxen, is perhaps one of the worſt pieces of American huſbandry. Yet how frequently may we ſee large farms managed in no other way!

Bees ought to be more commonly raiſed than we find them. At a ſmall expence they may be increaſed to any number. And what is particularly worthy of notice in their hiſtory is this, that all the product of their induſtry is clear gain, ſince the wax and honey are extracted from flowers, without any damage or loſs to the land or its proprietor, and if not thus ſaved, would irrecoverably periſh. It is alſo true, that cultivated lands abounding with clover and buckwheat, afford food for very great numbers of them. Therefore, that ſtate of agriculture which is beſt adapted to our convenience and comfort, is at the ſame time moſt ſuitable to the multiplication of theſe inſects. On account of the dearneſs of ſugar, it muſt be very advantageous to raiſe bees, becauſe honey

in many parts of domeſtic economy, is an excellent ſubſtitute for the product of the cane. It ſeems to me, as bees can be increaſed in number as far as food will admit, and as honey can be uſed in ſo many caſes inſtead of ſugar, that by due attention to this object, ſo much of this wholeſome ſweetening may be provided, as to leſſen in a large proportion, the importation of foreign ſugar.

Too much pains cannot be taken to improve the breed of our ſheep, particularly as far as it reſpects their wool. This great article of clothing, ſo ſeduouſly watched by the Engliſh and Spaniards, has been too much neglected by our citizens. I know of no phyſical reaſon why the American ſheep ſhould not yield fleeces as large and fine as thoſe of Europe. Our manufactures of broad cloth and other woollen goods will require an increaſing ſupply of this material, and will ſoon, I truſt, furniſh ſuch excellent kinds, that our beaux ſhall take a pride to array themſelves in homeſpun. In point of ſalubrity, I am bold to ſay that wool far exceeds linen or cotton, and in our variable climate is ſo peculiarly calculated to guard the body againſt the viciſſitudes of the weather, that every valetudinarian ſhould wear flannel to regain his health; each well perſon to preſerve it. A flannel ſhirt may be called the palladium of health. The ſuperior neatneſs of linen in our dreſs, is but poorly compenſated by the unwholeſomeneſs of it.

Concerning the *wheat-inſect*, I am happy to obſerve that it ſeems to be rather on the decline. Yet ſome fields of wheat were much injured by it before winter ſat in. It is not improbable, that like other plagues of a ſimilar nature, it has its period, and perhaps the time of its viſitation may be now nearly paſt. Some months ago, I forwarded ſpecimens of it to ſome European naturaliſts, with a view to find out whether it had ever been known in that quarter of the world; ſince which I have been aſſured by

Sir *Joſeph Banks*, preſident of the royal ſociety of London, that it does not exiſt in England, and that he has no reaſon to believe its exiſtence in any part of Germany. That gentleman, whoſe zeal and ſucceſs in enlarging the bounds of human knowledge none of you are ſtrangers to, with a generous deſire of affording every aſſiſtance in his power to overcome this deſtructive animal, ſent me the learned and ſplendid Italian work of count *Ginanni* of Ravenna, upon the diſeaſes to which wheat is ſubject in its growing ſtate. (Delle malattie del grano in Erba in Pesaro 1759. 4to.) In the ninth chapter of the ſecond part of this work, the inſects deſtructive to the Italian wheat, are particularly deſcribed and enumerated to the number of fifty different ſpecies and more; but upon diligently examining the characters and plates, there given of them, I cannot find the American wheat-inſect noted. It is probable, therefore, this fly is not an inhabitant of the ſouth of Europe, or it would not have eſcaped *Ginanni's* accurate ſearch. Though perhaps the inſect mentioned, but not accurately deſcribed by Mr. *Chateauvieux*, may be the one now alluded to. Of this, however, his brief account of it, and the want of an engraving, do not permit me to be poſitive. As long as it continues to diſtreſs us, we can only counteract its attacks by richly manuring our fields, and late-ſowing our ſeed. We are almoſt entirely in the dark reſpecting the hiſtory of the inſects injurious to our uſeful plants, and that man would be laudably and beneficially employed, who ſhould collect what is knowable concerning the different moths, bugs, flies and worms, which infeſt our fields and gardens. A work of this kind, executed after the manner of *Ginanni's*, or upon the plan of *Reaumur's*, would be a capital addition to our Georgical fund of knowledge.

If the chamois-goat of the Alps was turned out upon the Alleghany mountains, it is very likely he would thrive and multiply there.

Heath-hens, teal and black-ducks, might probably be eaſily tamed, if attempts were judiciouſly made; and the acquiſition of theſe fowls would add richly to our ſtock of domeſtic poultry.

But I forbear to dilate on any more of theſe particulars. My hearers have the numerous volumes written within a few years, on œconomical ſubjects, in the different modern tongues, diſplayed before them; or if their claſſical taſte ſhould lead them to turn over the pages of the Latin authors, whoſe works are extant, *Columella* and *Cawley* will afford them abundant pleaſure, while the *Georgica of Virgil*, and the *Prædium Ruſticum of Vanier*, ſhall convey the moſt ſolid inſtruction to their minds.

Experiments and Obſervations on Calcarious and Gypſious Earths, by Mr. Chancellor LIVINGSTON.

THE uſe of *gypſum* as a manure, ſeems in ſome meaſure to have created a new æra in agriculture; prior to this it was generally admitted, that though farming might rank among the rational amuſements, it could not be conſidered as a profitable employment for thoſe whoſe avocations or diſpoſitions do not permit them to attend to that infinite catalogue of minutias, that high wages to the laborer, and the low price of produce render eſſential in our rural economy. The farmer's profit, being the joint reſult of the fertility of his ground and his labor, the exceſs of the firſt can only compenſate for a deficiency of the laſt. Thus the acquiſitions of the gentleman farmer, (who may lay his account in being worſe ſerved than the common huſbandman) muſt be principally derived from the means which a larger capital affords him, of fertilizing his ground.

Theſe means, however, are too often beyond the reach of thoſe, even, who are willing to purchaſe them. Calcarious earths are within every man's reach, and yield ſo certain a return from ſoils to which they are adapted, as to enſure a decided profit upon the capital employed in procuring them.

It is now three years ſince I have commenced my experiments upon *gypſum*. I ſhall lay the reſult of them before the ſociety; though they may not appear new to many gentlemen preſent, they may incite others to a farther proſecution of this ſubject, and to a more regular and accurate regiſter of their experiments, than can be expected from one in my ſituation, who can only purſue agriculture as an amuſement—which muſt, like every other pleaſurable relaxation, give way to the duties which my ſtation requires.

No. 1.

[*July*, 1789.] After my buckwheat was come up, I dreſſed one fourth of an acre, with a buſhel and an half of *gypſum*, ſowing three pounds of clover ſeed. It appeared to me, that the buckwheat was ſomewhat the better for it, but a very heavy rain lodging it when in full bloſſom, I could make no accurate experiment—ſoil, a poor worn out ſandy loam.

[*June*, 1790.] Clover on this ſpot extremely fine; produce at one cutting, one ox-load, or half a ton; the after-graſs fed down.

[*June*, 1791.] Clover equal to the laſt year, except that it was more mixed with natural graſſes—after graſs worſe than laſt year, a great deal of ſummer graſs having got in.

N. B. As weighing hay immediately after it is made, would be very inaccurate, from its drying after it is houſed—I eſtimate the tons in all theſe experiments by ox-loads, at the rate of one ton to every two loads; which, however, I believe it will be generally found to exceed.

No. 2.

[1789, *April* 10.] Strewed over one third of an acre of rye, four and an half buſhels of *gypſum*, and ſeven pounds of red clover ſeed; the ſoil a poor ſandy loam, being the ridge of a hill, at the depth of ſix inches a ſharp red ſand which the plough often brought up.

[*July.*] Crop of rye ordinary, ſtraw uncommonly tall and ſpindled.

[*September.*] The clover has got to a ſurprizing height, a great part of it in bloſſom, the ground completely covered.

[1790, *June.*] This clover finer than any I ever before ſaw, many of the ſtems three feet long—the whole lodging, ſo that I was compelled to cut it before it was perfectly ripe—produce three large ox-loads. September 2d, crop very fine, being abſent when cut, I know not exact amount.

[1791.] Clover in every reſpect equal to the laſt year, fed down the after-graſs.

No. 3.

Three acres of ground of the ſame field, but in better heart, lying flatter, having the waſh of the adjoining hills—1787, well manured, and yielding corn and potatoes—1788, wheat and clover, and left for graſs—1789, mowed for hay, produce four ox-loads of hay. April 1790, dreſſed this with ſix barrels of *gypſum*. June, mowed for hay, produce ſeven ox-loads. Double of that produced by ſuch parts of the field as had no *gypſum*; but half a ton an acre inferior to that which was ſown over the rye, on much poorer ground; after-graſs very good; took no particular account of it, being abſent when cut.

[1791.] Graſs about equal to the laſt year's; more natural graſſes, and ſome weeds make their appearance; the after-crop not ſo good, owing to the extreme drought and a quantity of ſummer graſs getting in.

No. 4.

On a lawn of ſix acres, which has lain to paſture for ten years, a loam inclining to ſand, upon a clay bottom; ſome pains had been taken to get this in good graſs, and for that purpoſe it had been manured 1787, and cattle had been foddered the winter 1788 upon it; but it ſtill produced a great quantity of daiſies and ſorrel, and changed colour at every drought. April 1790, dreſſed one half of it, except a ſtrip of 100 paces long, and ten wide, in the middle of it, with ſix buſhels of *gypſum* to the acre, the other half with three buſhels of *gypſum*, and ten buſhels of unleached wood-aſhes mixed to the acre; in four weeks the effects of both were viſible, when a flock of ſheep were turned upon it, and it has ever ſince, even through all the droughts of this ſummer, 1791, though cloſe fed, maintained a moſt deep and beautiful verdure, being thickly covered with white clover and ſpear graſs; the weeds are deſtroyed. No diſtinction is diſcoverable between this which had the aſhes, and the *gypſum* without aſhes, while that ſtrip which had neither, has been parched during both ſummers, and yielded ſcarce any thing but ſorrel and other weeds.

No. 5.

On a dry hillock, conſiſting of a kind of flaty gravel, mixed with large ſtones upon a bottom of rock thinly covered with clay; its natural produce ſorrel and other cropping weeds, affording ſo thin a covering that the gravel and ſtones were always viſible through them; dreſſed April 1790, about two-thirds of an acre, with three buſhels and an half of *gypſum*; by the 26th of May it was covered with ſuch a coat of white clover as formed a beautiful contraſt with the reſt of the hill; the weeds were entirely deſtroyed; the flowering ſtems of the white clover were ſixteen inches long, and the bloſſoms ſo thick when in full bloom, as almoſt to cover the field. As it was

too ſtony to mow it was fed down with ſheep. From the firſt of April to late in the autumn 1791, it has diſplayed the ſame beautiful appearance through the whole of this dry ſummer.

No. 6.

On three acres of ſtiff clay ground, laying very flat (part of a field that has been mown two years) dreſſed with ſix buſhels of *gypſum* to the acre. The appearance of the graſs during the ſummer 1790, of a deeper green than that of the reſt of the field; no great difference however in the firſt cutting of graſs; the after-graſs evidently more luxuriant than the reſt of the field, but having been fed down cannot eſtimate the difference. This ſummer, 1791, being remarkably dry, the above three acres were very ſuperior to the reſt of the field. The difference being, as I judged from counting the hay-cocks, as 7 is to 4; the beſt, however, not yielding more than one and one third ox-loads to the acre.

No. 7. On the ſame field.

[*Auguſt*, 1790.] Spread on a rood of the field laſt mentioned, one buſhel of pulverized limeſtone. This ſummer, 1791, the effects of it were diſcernable to an inch, both in the verdure and luxuriancy of the graſs: the difference between that and the parts adjoining were in its favor (as I judged by counting the cocks) as 7 to 4; from whence I infer, that on clay ground, eight buſhels of pulverized limeſtone, is at leaſt equal to ſix of *gypſum*.

No. 8.

Tried at the ſame time, the effects of pulverized limeſtone, in the proportion of ten buſhels to the acre, on part of the ſtrip which I had left on the lawn, mentioned in experiment No. 4. The ſummer 1791, it acquired the ſame verdure as the part that had been dreſſed with *gypſum*.

No. 9. On Indian Corn.

[1791.] Eight acres of Indian corn were planted in a black boggy earth, from three inches to ten deep, over a ſpungy wet bottom of ſtiff red clay, intermixed with ſmall pebbles of iron ore. The whole was manured in the hills with long litter and ſtable dung; to four acres of this manure, was added at the firſt hoeing, a table ſpoonful of *gypſum* to a hill, two acres were manured with pulverized oyſter ſhells—three rows with aſhes, three with pounded bones—a half pint of each to a hill—three with a ſpoonful of ſalt; the remainder of the field had no other manure than the dung. The ſheep breaking in eat all the ſalted hills, and damaged thoſe manured with bones ſo much as to defeat the experiment; the remainder of the field was ſo much alike as to enable me to draw no inference from it in favor of either of the manures; from thence I am led to infer, that upon this rich wet ſoil they are of no uſe.

No. 10.

[1791.] Manured two rows of corn in my garden—ſoil a rich ſand, that has been fifteen years under garden cultivation, with *gypſum*, a ſpoonful to a hill—two with pulverized oyſter-ſhells—two left unmanured; the difference ſo trifling, that no inference can be drawn from it in favor of thoſe manures. This is a remarkable fact, ſince the ſoil, independent of its richneſs, was of that kind which is moſt benefitted by *calcarious* manures, and confirms what the experiments of the clover upon the rye field had before intimated, to wit, that the operations of this manure is very little aided by the natural fertility of the ſoil.

No. 11.

In order to render theſe experiments more extenſive than the ſoil of my own farm would admit, I furniſhed ſeveral of my tenants with *gypſum*, and attended to the application of it. I ſhall ſelect from

them only three out of many experiments on corn, the reſult of all being nearly ſimilar to theſe:

1ſt, Was on a field of twelve acres of corn, the ſoil extremely poor, and incapable of yielding any thing without manure, except buck-wheat and rye. It was that ſpecies of land which is known by the name of ſhrub oak and pitch pine plain; five acres of this was manured with ſtable dung—three rows with pulverized oyſter-ſhells—three with unleached aſhes, half a pint of each, and the remainder with *gypſum*, a table ſpoonful to a hill.

In the beginning of the ſummer the dunged part made the fineſt appearance; the aſhes next, but as the drought came on the *gypſum* and ſhells, gained upon both. The aſhed corn turned yellow, and that which was dunged was neither ſo large nor ſo well loaded, nor of ſo deep a green as that dreſſed with *gypſum* or ſhells.

On another field of ſix acres treated in the ſame manner (the ſoil being ſomewhat better) being a light loam upon a clay bottom, I could perceive no difference between the corn produced by theſe manures. The *gypſum* and ſhells were however put to the ſevereſt trial, as they ſtood on the top of a ridge, while the others (from which miracles were not expected) occupied the flat ground below.

The third experiment was on a loam inclining to clay, three acres was dunged with ſtable dung, put as uſual in the hills; three were dreſſed as above with *gypſum*; two rows were left in the middle of theſe without manure, and three were treated with wood aſhes, half a pint to a hill. That without manure was ſo pinched with drought as to yield nothing; the aſhed rows were inferior by half in the ſize of the ears, and the general yield; the dunged part was good, but ſtill fell far ſhort of that which was treated with *gypſum*.

No. 13. Flax.

[1791, 20*th May*.] I viewed a piece of flax, about half an acre, ſown by a poor tenant, very injudiciouſly, on a dry ſandy declivity : it looked (as might be expected) extremely ſickly ; and as it was evident that it had not ſufficient ſtamina to ſuſtain the heat of ſummer, he propoſed ploughing it up. I took upon me to be its phyſician, and preſcribed three buſhels of *gypſum*, to be taken the next morning, while the dew was on the ground. I ſent him the doſe, which was faithfully adminiſtered, and I had the ſatisfaction of ſeeing him gather more flax from this half acre, notwithſtanding the uncommon drought of the ſummer, than any acre in this neighborhood afforded. —*N. B.* I borrowed this hint from Mr. William Cockburne, who had experienced the beneficial effect of *gypſum* on flax.

No. 14. Oats.

[1791.] Five acres were ſown the laſt ſpring, on the ſame kind of black ground, which I have deſcribed in experiment No. 9, being part of the ſame field : one was manured with *gypſum*, ſeven buſhels to the acre ; one with ſhells pounded, but not ground, fifteen buſhels to the acre ; the reſt had no manure. I could perceive no difference, the whole field being equally good.

No. 15. Wheat.

I have made trials on three different fields of wheat, of the efficacy of this manure, but have no reaſon to conclude from any of them, that this grain received benefit from it.

No. 16.

[April 1791.] Two acres of a ſtrong loam, being part of a field of wheat, were manured with pulverized oyſter-ſhells, fifteen buſhels to the acre : though this appeared ſomewhat better than the reſt of the field, the difference was ſo trifling as to warrant no concluſions in its favor.

No. 17.

[*April*, 1791.] Strewed pulverized oyſter-ſhells over half an acre of poor worn out ground, on which rye graſs had been ſown the year before; could not perceive that the graſs was benefited by it.

No. 18.

Strewed ſeven buſhels of ground oyſter-ſhells over half an acre of rye, in the poor ſoil before deſcribed in experiment No 11, and three buſhels of *gypſum* on another half acre adjoining; ſowed ten pounds of red clover ſeed over both; the rye not better than the reſt of the field; the clover ſeed was bad, and came up thinly; that, however, dreſſed with oyſter-ſhells, much better than that manured with *gypſum*. I own this ſurpriſed me, as the reſult of every other experiment of oyſter-ſhells on graſs (having made ſeveral upon a ſmall ſcale, which I have not noted) has been unfavorable. I, however, attribute that to the extreme poverty of the ſoil, which imbibed the oils contained in the freſh oyſter-ſhells, and thus ſuffered the air to make an impreſſion upon them, which I ſuppoſe it could not do immediately on richer grounds.

From the above experiments, I think we may fairly draw the following inferences:

1ſt, That *gypſum* in ſmall quantities has no viſible effect on wheat or rye.

2d, That it is uniformly beneficial to Indian corn, unleſs it be in very rich or very wet ſoils.

3d, That it is beneficial to flax on dry poor ſandy land.

4th, That it is peculiarly adapted to the growth of clover in all dry ſoils, or even in wet ſoils in a dry ſeaſon.

5th, That limeſtone pulverized has ſimilar effects with *gypſum*; whether it is better adapted to wet ſoils, I cannot yet determine.

6th, Another fact ſeems to be very well eſtabliſhed, though I can ſay nothing of it from my own ex-

perience, to wit, that its effects as a manure are hardly perceivable in the vicinity of the ſea.

I know not whether theſe facts will be deemed ſufficient to ſerve as the baſis of a theory on the nature of this manure; but as this ſubject appears involved in difficulties which no one has yet attempted to remove, I conceive that the man who in doubtful caſes hazards even a defective theory, helps to enlighten a ſubject, by provoking others to combat his opinion. The firſt ſtep in determining how *calcarious* or *gypſious* earths operate as manures, is to acquire a knowledge of their conſtituent parts; and for that purpoſe I could have wiſhed for a more accurate analyſis of them than my imperfect knowledge of chymiſtry has permitted me to make. I mixed a quart of pulverized *gypſum* with an equal quantity of wood aſhes, and leached it with boiling water; as it evaporated, it depoſited a ſalt of a dirty brown colour, the cryſtals imperfectly formed. It was ſaturated with a ſolution of potaſhes, and, when cold, ſhot into regular cryſtals, which were ſharp at the point, and broad at the baſe, not unlike to the blade of a ſmall ſword. Though this is not the form of vitriolated tartar (which is the ſalt produced from the vitriolic acid and a vegetable alkali) the difference may have ariſen from a metalic gas, which might have been detached from the glazing of the veſſel in which it was boiled. This I the rather imagine, as I afterwards obtained vitriolated tartar by ſuffering the liquor to evaporate ſlowly in the open air, to which it was expoſed for three weeks. Pulverized limeſtone, treated in the ſame way, gave a neutral ſalt, conſiſting of a great number of long thin needles, equally thick at either extremity. As this is the ſalt produced by combining fixed air with the vegetable alkali, it proves that the eſſential ſalt of limeſtone is *fixed air*, which ſhews a difference between that and *gypſum*, that may in certain circumſtances be of conſequence, particularly in ſoils that

abound with a vitriolic acid, as many boggy ſoils do; in which caſe the limeſtone ſhould be preferred, ſince the elective attraction between fixed air and *calcarious* earth is weaker than that which exiſts between this and the vitriolic acid; the firſt will therefore be diſlodged, and the ſuperabundant acid of the ſoil be abſorbed by the *calcarious* earth.

It is evident, then, that *gypſious* earths contain an acid, capable, when united with an alkali, of forming a neutral ſalt, in which water is a principal ingredient. This earth alſo contains phlogiſton, or a principle of inflammability; as I infer, 1ſt, from limeſtones being uſed as a flux for ſubſtances which cannot otherwiſe be reduced by fire, as pure clay, &c. &c. 2d, from its having once formed part of an organized animal; 3d, from ſome experiments of Dr. Prieſtly, in which he expreſsly declares that he got a conſiderable quantity of inflammable air from chalk, by the application of heat; 4th, from the following experiment, which, being new to me, ſurprized me much: I put a few ſpoonfuls of chalk into a glaſs bottle, to which I poured ſtrong white wine vinegar, and corking the bottle (after the firſt ebulition was over) at the end of a fortnight, I found the vinegar from a tranſparent, converted into a dirty black liquor. This change of colour I can only account for by ſuppoſing that the phlogiſton contained in the chalk was ſet looſe by its decompoſition, and imbibed by the vinegar.

Thus, then, we find in a *calcarious* earth, moſt of the elements that go to the compoſition of vegetables, to wit, earth, air, fire, water; and an acid, capable, by its combination with alkalies, of forming a ſalt which ſhall diſſolve in water, and fit all theſe ſubſtances for entering the abſorbent veſſels of plants.

[Watſon's El: 257.] Vegetables, on diſtillation, yield earth, an acid liquor, fixed and inflammable air, an oil and an alkali. In ſome vegetables the acid and alkali are actually found united, as in tobac-

co, ſun-flowers, &c. and although chymiſts doubt whether the alkali is not produced from the acid in the act of combuſtion, yet I think this queſtion is decided by the analyſis of tartar, which the vinous juice of moſt plants yield, and which is found to conſiſt of an acid and an alkali. Macgraff obtained pure nitre from it by ſaturating it with nitrous acid.

From this analyſis of limeſtone, which only differs from *gypſum* in the acid with which it is combined, we might be led to conclude that it aided vegetation, by being converted into the food of plants. But how is it poſſible to conceive that ſix buſhels of this manure, which does not weigh five hundred pounds, ſhould be converted into twenty thouſand weight of graſs, which it will produce in two years on the pooreſt ſoil? Why will it not have the ſame effect in the vicinity of the ſea, or on wet grounds? And whence do the plants derive their oil and alkalies, ſince neither are found in this manure?

It has been ſuppoſed, that though *gypſum* in ſuch ſmall quantities may not ſerve as food, it may ſtill operate as the phyſic of plants, and ſtrengthen their power of digeſtion. This ſuppoſition is liable in my mind to ſtrong objections. 1ſt. I can hardly conceive that plants (whoſe lives it would ſeem muſt be very regular) ſhould have ſuch weakly conſtitutions as to require phyſic from their infancy. 2d. If we judge from the analogy between animals and vegetables, we ſhould ſuppoſe that a ſtimulus conſtantly applied would loſe its effects, and ultimately relax and weaken the patient. 3d. If plants were thus effected by *gypſum*, its advantages ſhould be (contrary to the fact) comparatively greater in rich than in poor ſoils. To increaſe the appetite where there is nothing to eat, would be with Shakeſpear's Gramio, to furniſh the muſtard without the beef. 4th. As plants in wet ſoils are probably moſt ſubject to crudities and indigeſtion, it is ſuppoſable that they would be moſt be-

nefited by ſtimulents, and yet they receive but little benefit from *gypſum*.

By theſe objections (which perhaps appear ſtronger to me than they otherwiſe would from the ſupport they afford to my ſyſtem) I am induced to reject each of theſe theories, in order to make room for the following, which ſuppoſes that *calcarious* and *gypſious* earths furniſh food to plants, without being conſumed by the ſupply they afford, that they are the ſtewards, and not the phyſicians of the vegetable family.

I have obſerved that two of the ingredients that enter into the compoſition of plants, to wit, the alkali and oil, were not uſually found in *calcarious* earths, the freſh ſhells of fiſh, and a few others excepted, from which a portion of oil and a volatile alkali may be extracted. I preſume, however, that an ample ſupply of theſe is neceſſary to the vigorous health of plants; and that *gypſious* earths afford them by the following proceſs.

The affinity or attraction between alkalies and the acid of *gypſum*, is ſtronger than that which exiſts between the ſtone and its own acid. That is to ſay, the acid will leave the ſtone or earth to unite with the alkali, as appeared by the experiments I have mentioned, by which neutral ſalts were obtained by leaching pulverized *calcarious* ſtones with the lees of aſhes.

When therefore an alkali comes in contact with pulverized *gypſum*, it will attract the acid, and combining with it and water, form a neutral ſalt, while the *calcarious* earth, deprived of its acid, becomes cauſtic. Let us then ſuppoſe *gypſum* pulverized and ſpread thinly over the earth, it is evident that in this caſe it expoſes a large ſurface to the action of the air; if this contains a volatile or vegetable alkali, which I ſhall by and by ſhew that it does, this alkali will ſeize upon the acid of the ſtone, and form a neutral ſalt. Salts I believe cannot chryſtalize

but by the addition of water, which in their combination loſes its fluidity and becomes a ſolid body; the fluidity of water depends upon its heat; it muſt therefore before it becomes ſolid, part with its heat, probably in the form of inflammable air. As all plants poſſeſs this, they muſt have ſome means of ſeizing upon it when brought within their reach. They will therefore either abſorb it by their leaves, or it will attach itſelf to the water that it finds in the air or on the earth, and thus be imbibed by the plant. Chymiſts ſuppoſe that this air which becomes fixed in plants, cauſes the production of oils, though by what combination they are not yet ſatisfied. (*Fourcroy's* Chymiſtry, 55, ſecond edition.)

This then is one mode in which *calcarious* earth may ſupply the oils and inflammable principle found in vegetables; ſince plants imbibe inflammable air and emit it pure, retaining the phlogiſton or inflammable part, which is known to be a principal ingredient in them; the acid and alkali will alſo be furniſhed, when the moiſture of the air, dews or rain diſſolve the neutral ſalts they have formed, and by rendering them liquid diſpoſe them to enter the abſorbent veſſels of plants. In this ſolution, the water which had loſt its heat where it chryſtalized, will again reſume it with great rapidity from the air in contact with it. As the repulſive power or elaſticity of the air depends like that of all other fluids upon heat, it is not unreaſonable to ſuppoſe that the ſudden aſſumption of heat from the inflammable air which compoſes a great proportion of the atmoſpheric air, will decompound it, and compel it to depoſit its water, earth, oils and whatever other ſubſtance is found floating in it. If inflammable air is contained in a receiver, and an electric ſpark paſſed through it, it may be made to depoſit a conſiderable quantity of water, which is always combined with it. In this way then oils and even earth may be ſupplied, for it is certain that the water contained in the at-

moſphere poſſeſſes a portion of earth, and perhaps no other earth but this is ſufficiently atinuated to enter the abſorbent veſſels of plants. Thus a gallon of rain water diſtilled, yields about ſixty grains of *calcarious* earth, which accounts for the encreaſe of certain plants without either earth or water, and which are ſtill found to contain both. Should it be denied that the attraction of the heat from the atmoſphere is capable of decompounding it, it will nevertheleſs be admitted that there are an infinite variety of vapors which are exhaled by the ſummer's ſun, which owe their levity to heat only, and not being permanently elaſtic, muſt fall when the heat is attracted from them. Thence the fertility occaſioned by dews impregnated as they always are with a variety of heterogeneous ſubſtances; ſuch of thoſe vapors therefore as float near the earth's ſurface (and thoſe will be moſt fertile) will ſuddenly be condenſed by any extraordinary degree of cold, which the ſolution of the ſalt I have mentioned may occaſion. But the effect of the *calcarious* earth does not ſtop here; it is not ſatisfied with a ſingle operation, but like a faithful ſteward ſtill exerts itſelf for the ſupport of the vegetable family committed to its care. This earth, when deprived of its acid is rendered cauſtic, and will therefore greedily imbibe the acid from the air, after which it will be brought back to its original ſtate, and will form new combinations with alkaline vapors, and the ſame proceſs will be continually repeated, till it is itſelf diſſolved in water, borne away by the air, or abſorbed by plants, to all which caſualties it is ſubject. That acids exiſt in the air is proved, 1ſt, From their being capable not only of evaporation, but of being rendered permanently elaſtic, and even in this ſtate capable of combining with alkalies, which can in like manner be rendered permanently elaſtic. From their union, a white cloud is produced, which contains a neutral ſalt. 2d, If quick-lime is kept dry, and expoſed a

long time to the air, it will become effete, and loſe its cauſticity by its re-union with an acid. 3d, if a cloth moiſtened by a ſtrong ſolution of pot-aſhes is expoſed to the air, it will be covered with ſaline chryſtals of vitriolated tartar. 4th, if the earth from which ſalt-petre has been made is expoſed to the air, it will recover the nitrous acid it had loſt. In ſome parts of the Eaſt-Indies ſalt-petre is made by ſetting fire to a long graſs which grows on the declivities of hills; that aſhes ſerves as the alkaline baſe of nitre (which is a neutral ſalt compoſed of an acid and an alkali) the acid of which floats in the air and combines itſelf with the alkali, forming the ſalt which is waſhed down by the rains and received in reſervoirs at the foot of the hills, where the water is evaporated and the ſalt chryſtalized.

This part of the theory will therefore hardly admit of a doubt. The exiſtence of an alkali in the air I think is proved from the extreme volatility of ſome alkalies; from the poſſibility by heat alone of rendering them permanently elaſtic; from their being continually exhaled from burning and putrifying ſubſtances. Dr. Black imputes the ruſt of metals to the action of an alkali exiſting in the air, and ſays alkaline ſalts are often collected from the corks of bottles containing acids—the atmoſphere itſelf is a compound, which differs ſo eſſentially from pure vital air, as to contain only 28 parts in 100 of it; the reſt is fixed and inflammable air, fire, earth water, and an infinite variety of other ſubſtances, beſides vapours that are not permanently elaſtic. The pureſt earths, the hardeſt metals, may be converted into air, and float in the atmoſphere, which may itſelf be changed into water, and water into ſolid earth.

What ſtrikes me as a farther evidence of the exiſtence of an alkali in the air, is, that ſuch parts of flint or limeſtone, as are expoſed to the action of the air and water, are always white and ſoft; flint I believe is not ſoluble in acids, but will diſſolve in alka-

lies; nor can the decompoſition of limeſtone, be attributed to the action of acids, ſince, as this is very gradually effected, it is to be preſumed, that if the acid in the air was ſtrong enough to expel the fixed air, it would unite with the *calcarious* earth, and ſtill form a ſalt with a earthy baſis of a different ſpecies. May we not then conjecture, that this change in the limeſtone is cauſed by a combination of the kind I have mentioned; and the rather, as we find when it is expoſed only to the action of the air, and not waſhed by water, that it forms ſaline effloreſſences, which ſpeak the union of alkaline acid, and earthy ſubſtances. Dr. Watſon tells us, that from the mortar of an old barn that was covered with theſe effloreſſences, he extracted perfect chryſtals of pure nitre, without the application of any alkali; and yet we know, that an alkali and an acid are eſſential in the compoſition of nitre. He does not attempt to account for this. I ſhould however preſume, that it could only happen by the lime in the mortar, having recovered a nitrous acid from the air, inſtead of the fixed air it had loſt, and that the putrid exhalations from the vegetables contained in the barn, had furniſhed the alkali, and that from the combination of theſe, with the moiſture of the air, reſulted thoſe effloreſſences that formed the nitre. Dr. Black aſſerts, that the effloreſſences found in damp caverns or cellars in England, contain a great proportion of *foſſil alkali*—this alkali is not found in Europe, unleſs combined with ſea ſalt, of which it makes the baſis; and yet theſe effloreſſences are derived from the moiſture of the air: does not this argue the exiſtence of an alkaline ſalt in the atmoſphere?

It may be objected, that if alkalies and acids exiſt in the atmoſphere, they would by their union form neutral ſalts in the clouds. Though I by no means conſider this as a neceſſary conſequence, ſince the repulſive power of the particles of air, may keep the alkalies and acids they contain without the ſphere

of each others attraction, yet I am inclined to believe, that this combination does actually take place. To the heat generated by this combination while the ſalts are forming, I attribute the variations that are felt in the degrees of heat that prevail at different times, in the ſtilleſt weather, when ſummer heat ſhould be uniform; to the ſolution of theſe ſalts, that cold which generates froſt and hail in the warmeſt ſeaſons.

There are places among the mountains, and in great foreſts, where froſts prevail every month in the year. There are others, which by clearing are freed from this calamity, which is known ſo often to diſtreſs the firſt ſettlers of a new diſtrict. If froſts were occaſioned merely by the influence of cold winds, the places moſt expoſed to theſe would be ſubject to them, and woods and vallies would afford a ſhelter againſt them, as indeed they often do againſt froſts which are derived from this ſource. The reaſon of the prevalence of froſt in woods and ſheltered vallies, when the general temperature of the air elſewhere is warm, I ſhould take to be the greater exhalations of thoſe ſubſtances that form ſalts, and the ſolution of them by the vapors that ariſe from theſe moiſt and ſheltered ſituations. Hail too cannot be deſcribed to any other cauſe; if it owed its origin to cold only, it would be more prevalent in winter than in ſummer; it would, like ſhowers of rain, extend over large tracts of country; and it would fall from much greater heights than it generally does. But hail, like froſt, is often confined to a very narrow region, prevails in the warmeſt weather, and in long cloſe vallies at a diſtance from the ſea, more than in the open country or near the ocean. Thus France and Italy are extremely incommoded by hail-ſtorms; in England they are very rare. All theſe phenomena correſpond with the theory laid down; in ſummer

NOTE. The ruſt of iron will yield a volatile alkali—ruſt is acquired by expoſure to the air. [*Black.*]

are the greateſt exhalations of volatile alkalies. Theſe are more like to ariſe, and form their union with the ærial acids in vallies where the air is moſt compreſſed; in theſe ſituations they frequently meet with thoſe moiſt clouds that diſſolve them ſuddenly, and afford the water that is by the ſolution of the ſalts converted into hail. The ſalt compoſed of an acid and a volatile alkali, as ſal-amoniac, diſſolves with great rapidity when it comes in contact with water, and generates a great degree of cold; while common ſalt diſſolves much ſlower, and does not generate ſo much cold by 18 degrees in its ſolution; for which (among other reaſons) hail prevails leſs near the ſea than at a diſtance from it. That ſuch ſalts are formed in the air is farther proved from the experiments of Margraff and Doctor Ratty, who both obtain a bitter ſalt from ſnow and rain water in diſtillation, but much leſs from ſnow than from rain water. Doctor Black admits that both nitre and common ſalt are formed in the air. A farmer needs no better proof of the exiſtence of the latter in the atmoſphere on the *ſouth* ſide of the Highlands, than the indifference which cattle ſhew *there* for ſalt, and the eagerneſs with which they ſeek it at a greater diſtance from the ſea. I ſhall now endeavor to reconcile certain phenomena in the operation of *gypſum* to this theory.

1ſt. It benefits dry more than wet ſoils.

Becauſe *calcarious* and *gypſious* earths are at all times ſoluble in the water. In wet ſoils they will be diſſolved and waſh away; beſides, the moiſture which envelopes the particles of *gypſum*, protects it from the action of the air, and prevents the combinations on which this theory is founded. As limeſtone is leſs ſoluble in water than *gypſum*, perhaps if applied in large quantities, it may be more beneficial to moiſt land.

2d. It is proportionally more advantageous to poor than to rich ſoils.

1ſt, Becauſe the putrid vegetables which compoſe a rich mould afford a ſufficient quantity of alkalies, oils and acids, but principally becauſe after the *gypſum* has parted with its acid by combining with the alkali, as before ſuppoſed, its earth being thereby rendered cauſtic, combines with the oils with which ſuch ſoils abound, and is thus ſheltered from any further operation of the air upon it. Perhaps too the vitriolic acid inſtead of uniting with an alkali, is attracted by the oils it finds in the earth; theſe it renders viſcous, and by its combination forms ſulphur, and thus is rather hurtful than ſerviceable—on ſuch ſoils pulverized limeſtone ſhould be preferred.

3d. It is leſs beneficial near the ſea than at a diſtance from it.

1ſt, Becauſe the winds that blow from the ſea which are the prevalent ſummer winds, and probably leſs impregnated with thoſe alkaline ſubſtances which putrid animals and vegetables afford, than thoſe which blow over a large tract of land.

2d, Becauſe it appears from experiments made in Ireland, that ſea ſalt is contained there both in rain and ſnow water. Sea ſalt is compoſed of the marine acid, and a foſſil alkali, to which latter the vitriolic acid found in *gypſum* has a greater affinity than the marine acid; it will therefore decompound the ſalt and unite with the foſſil alkali perhaps, (I ſpeak with deference, not knowing the fact) perhaps, I ſay, the foſſil alkali may be unfriendly to vegetation, or not of a nature to be abſorbed by the plant. In this caſe on the ſolution of the ſalt formed with it and the vitriolic acid, the latter would be abſorbed ſingly and the foſſil alkali being left, would form new combinations with the marine acid, which is found in the atmoſphere near the ſea, and be again converted into common ſalt, which is known to have little or no effect as a manure. That the vitriolic acid would be abſorbed, I infer from the preſence of vitriolated tartar in pearl aſhes, which ſhews that

the acid muſt have exiſted in the plants from which it was made, and from the following fact which I have ſeen in ſome writer on huſbandry :—A gentleman whoſe court-yard was overgrown with weeds, was adviſed to ſprinkle them with vitriolic acid, but to his great ſurprize he found that inſtead of killing them they grew with additional vigor. That *foſſil alkali* is unfriendly to vegetation, I infer from its not being found in any plant, ſome marine plants excepted. Perhaps in the vicinity of the ſea, if pulverized limeſtone could be afforded ſufficiently cheap, and was uſed in large quantities, it might be found beneficial, becauſe its acid or fixed air is not ſufficiently powerful to detach the marine acid from its foſſil alkaline baſe. This idea ſeems to be juſtified by the general uſe of chalk in England, and limeſtone gravel in Ireland, and the beneficial effects that are known to ariſe from the uſe of ſea ſhells applied in large quantities on Long-Iſland and elſewhere.

There is a remarkable fact which may perhaps be adduced to ſtrengthen my theory, and to ſhew that either the air or earth is leſs impregnated with alkalies near the ſea, than at a diſtance from it. The Long-Iſland farmers ſend annually a number of boats to collect the aſhes from the pot-aſh works along the banks of the Hudſon, and at the diſtance of two or three miles from it. Theſe they purchaſe at 2d. per buſhel ; pay the expence of a cartage to the river ; of a water tranſportation of 120 or 130 miles, and then cart it again two or three miles to their farms, while a North-river farmer, if the aſhes were given him, would not be at the expence of carting them three miles, This has by haſty obſervers been attributed to ignorance, or indolence in the latter. The reproach is unmerited ; the people on the north ſide of the Highlands are not leſs enterprizing or intelligent than thoſe on the ſouth ; they are the ſame people. The fact is, that lands near the ſea derive much greater advantages from alkaline manures,

than thoſe at a diſtance; aſhes will contribute to fertility every where, but much more ſo (if I can rely upon the information of intelligent farmers on Long-Iſland, compared with my own obſervations) in the vicinity of the ſea, than at a diſtance. I have myſelf never been able to procure half the graſs from an acre of land manured with 100 buſhels of undrawn aſhes, which coſt, excluſive of the expence of putting it on, £. 5, that ſix buſhels of *gypſum* has given me from the ſame field; it is alſo on my farm the leaſt permanent of all manures; the effect of it not being viſible after the ſecond year.*

I will intrude upon your patience one moment longer, while I mention another fact which appears to me to ſupport my theory.

It is generally aſſerted that *gypſum* renders the earth black. It is well known to thoſe who have been attentive to its effects, that bare ſpots in a field that has been manured with it, will diſcover a great number of ſmall black ſpecks, particularly on ſandy grounds that have been wet. It is alſo known that beds of oyſter-ſhells, and the thin ſtratum of earth that covers limeſtone rocks, is always black, like the richeſt vegetable mould. Now as theſe ſubſtances are white when reduced to powder, from whence can they derive the power of rendering the earth in contact with them black? Unleſs in their decompoſition they attract oils from the air, or communicate the phlogiſtion they contain to the moiſt earth, as the chalk appeared to do to the vinegar in the inſtance I have mentioned. We may add to this, that ground which lays over a ſtratum of limeſtone rock is leſs ſubject to froſt, and thaws earlier than any other ſoil. Both oils and ſalt have a conſiderable power in reſiſting froſt.

Should the ſyſtem I have endeavored to eſtabliſh be true, it will follow that *calcarious* earths are very

* Note—The chancellor's ſeat at Clermont, where his experiments were made, is 120 miles from the ſea-coaſt.

permanent manures in proportion to the quantity employed. For as I have before obſerved, if this is ſmall it muſt be frequently renewed, becauſe this earth is ſoluble in water, and will be carried off by it, or imbibed by the plants themſelves.

As far as experiment has gone, this opinion of its duration is fully juſtified. Oyſter-ſhells, craig, marle, laſt for ages in full vigor; theſe are all different modifications of this earth.

Whether my ideas on this ſubject are juſt or not, I confeſs I take a pleaſure in thinking them ſo. I claſs in my own mind this effect of *calcarious* earths with the proviſion which nature in the creation of coal mines has made for after ages. I conſider it as a proof of the duration of this globe for many thouſand years to come. It is evident that the vegetable tribes flouriſhed long before men were ſufficiently numerous to make war upon them; left to themſelves for centuries, they grew, flouriſhed, faded and died, and by their death and putrefaction, covered the earth with a rich mould, from which men and other animals have hitherto drawn their ſupport. This, however, muſt gradually diminiſh; vegetable ſubſtances are not ſuffered as formerly to cover every part of the earth; to die and putrify on the ſpot on which they grew; animals take more from it than they return; every rain draws down a part of it to the hidden caverns of the earth; every ſtream and rivulet hurries it into the ſea; every fire preys upon it; every breeze is impregnated with its ſpoils. Let us not, however, tremble for the fate of poſterity; the foſſils which the ſea affords, the vaſt quarries of marble, chalk, *gypſum*, marle, which all derive their origin from the ſame ſource, not only reſtore the loſs which the water occaſions, but, agreeably to this ſyſtem, compel the air to depoſit the ſpoils of the vegetable world, and the fires which have conſumed the old, to animate new plants.

Communications made to the Society, relative to Manures, by EZRA L'HOMMEDIEU, *Eſq.*

LITTLE or no attention before the late war, in Suffolk county and other parts on Long-Iſland, was paid to making manure; the land was eaſily tilled, and in moſt parts by cropping with wheat was ſo reduced, that on an average not more than five or ſix buſhels was raiſed to the acre. This mode of huſbandry was ſtill purſued, and although the land was gradually impoveriſhed, the farmer found the crop, although ſmall, more than would pay for his labor and expence. The wheat inſect, or Heſſian fly, as it is commonly called, put an end to this kind of huſbandry, and in that reſpect has proved a bleſſing inſtead of a curſe. No other way being found to prevent the injury to his crop by this inſect but by highly manuring the land, great attention ſince has been paid to making manure, which in many parts of the country has increaſed ten fold. This addition has been made by green ſea-weed taken directly from the creeks and bays; by drifted ſea-weed prepared in different ways; by making a compoſt with yard dung and turf; by mud taken from creeks and ſwamps; by leached aſhes; and by the fiſh called manhaden or moſbankers.

Experiments made with Green Sea-Weed.

A float is made of pine boards of between one and two tons burthen, at the expence of about four dollars, into which the ſea-weed from the bottom of the creek is raked with a wooden rake of ſimple conſtruction, the head being nine inches long and two inches ſquare; the teeth about ſeven inches long, and the handle ſix or eight feet, according to the depth of the water where it is uſed. A man will get four ox-cart loads of this weed in a day, and land it on the ſhore, for which you pay fourteen pence per load. It is commonly thrown from the boat in large long heaps, not unlike in appearance to long hay ſtacks; in this ſituation it ſoon heats, and by a fer-

mentation which takes place, the parts in a ſhort time are ſo ſeparated as to be too fine to be loaded with pitch-forks. Sometimes this weed is taken directly from the boats, carted and ſpread on the land deſigned for a crop of wheat, and immediately turned under the furrow. There appears to be no material difference in a crop produced from the weed taken directly from the creek and ploughed in, and that taken from the heap. Twenty-five buſhels of wheat have been produced from an acre with thirty loads of this manure, and fifteen buſhels from twenty loads on poor lands, which otherwiſe would not pay for the labor and expence of tilling; but this quantity is too much on an average; on ſuch poor land I ſhould think that thirteen buſhels to twenty loads of this weed, taking one year with another, is about the common produce. Many farmers are of opinion that one load of this manure is equal to a load of cow-yard dung for raiſing of wheat; but as cow-yard dung is various in reſpect to its quality, it is difficult to determine the relative value of each as a manure; within two years I have uſed more than two hundred loads of this manure for wheat only, but do not find it equal to good cow-yard dung by five loads in thirty. I have ſeen thirty buſhels of rye from one acre on poor ſandy land; no account was kept of the number of loads put on this land; I ſuppoſed there muſt have been near forty. It is a common obſervation, that after the crop, the land manured with this weed does not produce graſs equal to that manured with yard dung. This is owing to the graſs ſeed being carried on the land with the yard dung, when there is none in the ſea-weed; and a larger quantity of hay-ſeed ought to be ſown on the land manured with this weed, than on that manured with yard dung. This ſea-weed is made uſe of as a manure in raiſing Indian corn; being taken from the creek in the ſummer, it continues in the heap till the next ſpring; it is then ploughed under the furrow,

about twenty tons to the acre, and is found in ſome reſpects ſuperior to any other kind of manure for the raiſing of Indian corn, as it prevents worms and injury from drought. The laſt ſummer being very dry, much Indian corn was cut off by that means; but where the lands were manured by this weed, the corn was not affected.

This green ſea-weed, taken directly from the creeks, and put into hog-pens, and ſome dirt or turf thrown thereon, and being trodden and mixed together by the hogs, within a few weeks becomes very fine, when it is thrown out and more put in; in this manner large quantities may be made, which is generally uſed for dunging corn in the holes, and is a very good manure. It is to be obſerved, that this weed comes up in the ſpring, from the roots, and about harveſt, gets its full growth and falls down; by raking it from the bottom at that time, you get it when it is full of its juices, but if neglected, it loſes its virtue, becomes light and drives on ſhore, when it is but of little value to plough under the furrow. The raking the bottom, although many roots and conſiderable mud is taken up, yet it does not prevent a crop the next year: on the contrary, the crop is found to be better for raking the bottom the year before. It is further to be obſerved, that this weed growing on a muddy bottom, in a creek, is far preferable to that growing on a ſandy bottom, or on a muddy bottom in a bay.

The uſes made of drift Sea-Weed *from* Bays *and* Creeks, *as a* Manure.

The drift ſea-weed from bays, being waſhed by the waves, driven on ſhore, and there expoſed to the ſun, loſes its juices, and ſoon becomes a ſalt, dry huſk, and if in that ſtate turned under the furrow, will continue there twenty years. The beſt uſe made of this dry drifted weed, is to cover your wheat as ſoon as ſown; this anſwers a good purpoſe,

in keeping the wheat warm in the winter, and prevents its being killed by frosts. It answers a good purpose as a litter for horses, which being mixed with the horse dung and trod to pieces, and thrown out into a heap, is found to answer a good purpose. A few horses in the course of a winter, will make large quantities of this manure. The drifted sea-weed from creeks and bays, if taken green and put under the furrow, answers the purpose of a manure, in proportion to that raked from the bottom of creeks and bays, as about two loads to one. It is generally carried into cow-yards for litter, there being trod to pieces by the cattle, and absorbing their dung, adds much to the quantity, and becomes a good manure. But it is used to the greatest advantage in hog-pens. The general mode of preparing this manure, is as follows: Your hog-pen is made without a floor, contiguous to a hog-house or shed, where your hogs may be dry whenever they please; the pen should be hollowing in the middle, so that rain will run into it and stand for sometime, by which means the sea-weed is kept wet and washed from the salts, and sooner rots than otherwise it would do. This sea-weed is thrown into the pen as often as necessary, with turf or rich dirt and any kind of green weeds; very large quantities of manure may be made in this way, which is much better than cow-yard dung, especially for dunging corn in the holes, as it prevents the injury done to corn by grub worms and other insects. Mr. Joseph Glover, a person in my neighborhood, informs me, that last year, with two hogs kept in a pen the whole year, by throwing in the pen the drift sea-weed, turf, rich dirt and green weeds, as often as occasion required, he made twenty ox-cart loads or tons of good manure, which he computes to be worth twenty dollars, equal to his two hogs when fatted; so that his pork cost him nothing, except his trouble of tending his pen. An equal quantity and perhaps more manure,

may be made by hogs in a country, remote from the ſea, by putting in the pen, the freſh graſs growing on flats in rivers, (which not being impregnated with ſalts, will ſooner rot than ſea-weed) and by adding turf or rich dirt, and any vegetables not fit for fodder.

Of Compoſt *made with* Yard-Dung *and* Turf.

The turf in ſtreets where hogs and cattle run, is very rich, and if ploughed up in the ſpring and put into heaps like ſmall hay-cocks, by abſorbing the nitre in the air, and by a fermentation of the roots of the graſs which takes place, it becomes a good manure, eſpecially for wheat. This turf, or any other turf which abounds with the roots of graſs, is uſed in making a compoſt with cow-yard dung: the dung is carted from the yard as ſoon as you have done foddering your cattle—you firſt make a bed of this turf, of about ten loads, if you mean to make a heap of one hundred tons; on this bed you cart ten loads of dung, then cover the ſame with four or five loads of turf, made fine by ploughing and loading it in the cart, you go on in that proportion till you compleat your pile, which ought to be flat on the top, and well covered with this turf or other rich dirt, ſufficient to keep off the ſun from the dung. This manure is fit for uſe the next ſpring; but if not wanted at that time, it will be beſt to make another heap of the ſame, by cutting it down and throwing it with ſhovels into another heap; by this means another fermentation takes place, and the whole is better mixed, and is a very fine manure for wheat, corn or graſs. Great addition by this means is made to the quantity of your yard dung; and by this means alſo, you prevent any loſs of your dung by the moiſture being exhaled by the ſun during the ſummer; you have a clean cow-yard, which being well littered abſorbs the dung and ſtale of the cattle during the warm ſeaſon of the year, and becomes

ſufficiently fine to cart out before winter. It is the common practice of farmers to cart out their dung in the fall, and lay it on or near a piece of ground they propoſe to till the the next year ; it lies in that ſtate, expoſed to the rains about ſix months, which muſt waſh away much of its virtue.

The Manure *of* Mud *taken from* Creeks *and* Swamps.

Mud from the creeks on Long-Iſland and on the ſea coaſts of ſome parts of Connecticut, has been made uſe of as a manure with ſucceſs in ſome inſtances, when in others no benefit is experienced. This is owing to their uſing two kinds of mud. In order to determine which is fit for a manure, if you run a paddle, or pole, into the mud, and it ſticks ſo faſt that it is with ſome difficulty you pull it out, you may determine that mud unfit for manure, it being only loam, or clay ſoaked with water ; but if your paddle, or pole, is drawn out eaſily, the mud is fit for manure. This mud may be taken from the bottom, in floats uſed for ſea-weed, as above deſcribed. A ſort of hoe is uſed to take up this mud from the bottom, made by riveting an old hoe to an old iron ſhovel, at the top ; by putting a handle in the eye, you have the inſtrument with which you load a float almoſt as ſoon as you throw it out when brought to ſhore. A man may get as many tons of this mud in a day as he can of ſea-weed : it is carted into heaps, which ſhould not be ſo large as to prevent the froſt from penetrating through the whole. This mud being taken out in the ſummer, and expoſed to the froſts during the winter, in the ſpring becomes as fine as leached aſhes, and is a good manure, eſpecially for graſs : being ſpread in poor loamy land, it brings up white clover, ſimilar to aſhes, though it takes a larger quantity. I dunged corn in the holes with this manure, but it did not anſwer ; I put too much in a hill. This is likewiſe a good manure for wheat, but has not yet been much attended to ; but the

probability is, that it will be found equal to any other manure which can be procured at ſo ſmall an expence.

The mud taken from ſwamps is often uſed as a manure; I have known ſome which have proved very good, others again have not anſwered the purpoſe. The beſt I have ſeen are thoſe which, being cleared and drained, produce graſs, turnips, and other vegetables. Some of the ſwamps have a ſoil, or ſort of manure, ſome feet deep, and yield great quantities of good manure for wheat. Although the ſwamp be rich, and will produce extraordinary crops, yet the advantage of carting it away on poor land far exceeds any profit you can otherwiſe make from it. By carting it into heaps, and letting it lie expoſed to the froſts during the winter, it becomes mellow, and in many inſtances is found nearly equal to yard-dung. Some ſwamps, to appearance, look well, and promiſe to be good manure, when, on experiment, they prove uſeleſs. I know not of any way to determine without experiment—which may be done at a very ſmall expence.

The Manure *of* Leached Aſhes.

The manure of leached aſhes has been much uſed on Long-Iſland, and in Connecticut near the ſea coaſts, and is found to ſucceed beſt on dry loamy lands, or loam mixed with ſand. It is generally purchaſed on the North-river, and on Connecticut-river; it coſts, at the eaſt end of the iſland, nine ſhillings for forty buſhels, or one cart load, and is then carted by many farmers ſix and ſeven miles, to put on land as manure, and coſts them ſixteen ſhillings per load, including the carting; and yet the effects of it are ſo great and laſting, it has been conſidered as the cheapeſt manure you could procure. Of late years, the demand for aſhes has been ſo great, by being more uſed than formerly, that it is difficult for farmers on the ſea coaſt to ſupply themſelves with it in any

conſiderable quantities. Ten loads of this manure, on poor land, will produce ordinarily twenty-five buſhels of wheat, which exceeds by five dollars the expence of the manure, and the five dollars pays for the expence of labor in raiſing the crop. The land is then left in a ſtate for yielding a crop of hay of between two and one and an half tons per acre, which it will continue to do for a great number of years. In ſhort, no manure has been found, as yet, to continue ſo long in the ground as aſhes. What will be the reſult of the firſt manure in that reſpect is uncertain.

The ſcarcity of aſhes will be in proportion to the ſcarcity of wood on the ſea coaſts, where it anſwers beſt for a manure, and in a few years cannot probably be procured in any conſiderable quantities. I would propoſe to the ſociety to order an experiment to be made as a ſubſtitute for this article, and which will be of the ſame kind of manure; which is, to buy in New-York a barrel of the ſalts of lye, which it is ſaid will coſt fifty ſhillings; let a bed of earth be made in the field where you propoſe to uſe the manure; diſſolve this barrel of ſalts in any quantity of water which ſhall be thought ſufficient to impregnate five loads of dirt, and with a watering pot ſprinkle your bed of earth; then put on more earth, and water the ſame with the diſſolved ſalts, and ſo on, till the whole five loads partake of the ſalts in as equal a manner as may be; perhaps after ſome days it will be beſt to remove the whole, by ſhovelling the ſame into another heap, for the purpoſe of mixing it more equally; then cart the whole on half an acre, as manure for wheat, to be uſed in the ſame manner as you would the five loads of leached aſhes. If this ſucceeds, and is equal to five loads of aſhes, it will be a valuable acquiſition to the farmer, as theſe ſalts may be obtained in any quantities; the expence of tranſportation by water or land is inconſiderable, and will finally be a much cheaper manure than leached aſhes. This experiment might be tried on a ſmaller

ſoale; but as you cannot well purchaſe a leſs quantity of thoſe ſalts than a barrel, it is propoſed to uſe ſo much in the experiment, which will fully determine its relative value with aſhes.

The Manure *of* Fiſh.

Experiments made by uſing the fiſh called Menhaden, or Moſbankers, as a manure, have ſucceeded beyond expectation, and will likely become a ſource of wealth to farmers living on ſuch parts of the ſea coaſts where they can be taken with eaſe, and in great abundance. Theſe fiſh abound with oil and blood more than any other kind of their ſize. They are not uſed for food, except by negroes, in the Engliſh Weſt-India iſlands; and the price is ſo low, that it will not anſwer to cure them for market. They are eaſily taken in the month of June, when they come near the ſhores in large and numerous ſchools. Theſe fiſh have been uſed as a manure in divers ways, and on different ſoils.

1ſt. In dunging corn in the hŏles: put two in a hill in any kind of ſoil where corn will grow, and you will have a good crop. The Indians on the ſea coaſts uſed to dung their corn with wilkes and other ſhell fiſh, and with fiſh if they could get it.

2d. By ſpreading thoſe fiſh on the ground for graſs, a good crop is produced: put them on a piece of poor loamy land, at the diſtance of fifteen inches from each other, on the turf, expoſed to the ſun and air, and by their putrefaction they ſo enrich the land, that you may mow about two tons per acre. How long this manure will laſt, experience has not yet determined.

3d. An experiment was made the laſt ſummer by one of my near neighbors, Mr. Jonathan Tuthill, in raiſing vegetables with this fiſh manure. About the firſt of June, he carted near half an ox-cart load of thoſe fiſh on twenty feet ſquare of poor light land, being loam mixed with ſand. The fiſh he ſpread as

equally as he could by throwing them out of the cart; being expoſed to the weather they were ſoon conſumed: he then raked off the bones to prevent their hurting the feet of the children who might go into the garden, and ploughed up the piece, and planted it with cucumbers and a few cabbages. The ſeaſon was extremely dry, and but very few cucumbers were raiſed in the neighborhood, except what grew on this ſmall piece of ground, and here the production exceeded any thing that had been known; by his own computation and that of his neighbors, this twenty feet ſquare of ground produced more than forty buſhels of cucumbers, beſides ſome fine cabbages. I meaſured the ground myſelf, and make no doubt of the quantity adjudged to have grown on the ſame.

By putting theſe fiſh on the land for manure, expoſed to the air till they are conſumed, there can be no doubt that a conſiderable part of the manure is loſt by the effluvia which paſſes off the putrified ſubſtance, as is evident from the next experiment.

4th. Mr. Joſeph Glover, a farmer in Suffolk county, having a ſmall poor farm, for a few years paſt has gone into the practice of making manure with theſe fiſh for the purpoſe of enriching his land, which is a loamy ſoil, dry, and in parts light. He firſt carts earth, and makes a bed of ſuch circumference as will admit of being nine inches thick; he then puts on one load of fiſh, then covers this load with four loads of common earth; but if he can get rich dirt, he then covers it with ſix loads, and in that manner makes of fiſh and earth a heap of about thirty loads; the the whole maſs ſoon becomes impregnated and turns black. By experience he finds that fifteen ox-cart loads of this manure is a ſufficient dreſſing for one acre of his poor land, which produces him thirty buſhels of the beſt wheat by the acre; and the next year from the ſame land ſown with clover ſeed, he has cut four tons of hay, which he computes at two loads and an half by the acre. The expence of making this ma-

nure where the fiſh are plenty, cannot exceed three ſhillings per ton, and is the cheapeſt manure, conſidering its quality, of any yet known, provided it is durable, which cannot yet be determined. On ſome parts of Long-Iſland thoſe fiſh are taken in ſeins, and carted ſix and ſeven miles for the purpoſe of manure, and is found to be a very profitable buſineſs.

Mr. Glover relates a circumſtance which is curious, and confirms ſome experiments made by Doctor Prieſtly, and at the ſame time ſhews that you derive leſs benefit from thoſe fiſh when expoſed to the air, than when covered with earth. He made a heap compoſed of thoſe fiſh and earth, in the manner above related, near a fence where a field of wheat was growing on the oppoſite ſide. The wheat near the heap ſoon changed its colour, and grew luxuriant; and at harveſt yielded near double the quantity to the other parts of the field. He is confident that the wheat could derive no nouriſhment from the heap or compoſt by its being waſhed by rains to the ground on the other ſide of the fence where the wheat grew, and could be effected only by the effluvia ariſing from the putrefaction of the fiſh, and abſorbed by the leaves of the wheat.

On the Raiſing of Red Clover Seed.

By Ezra L'Hommedieu, *Eſq.*

RED Clover Seed of late years has become an article of exportation, by which the price has increaſed, and the production become very profitable to the farmer. More red clover ſeed is carried to market from Suffolk county than from the whole ſtate beſides. It is not uncommon for a farmer in that county to ſell thirty buſhels of this ſeed in a year which in many inſtances brings him more clear profit than all the reſt of the produce of his farm. As the raiſing of this ſeed is but very little attended to

in other parts of the ſtate, I ſhall deſcribe the manner of raiſing it in that county. It grows beſt on a light ſandy ſoil, on a light loamy ſoil, or on a ſoil of light loam mixed with ſand; the ſeed is collected both from the firſt crop and from the ſecond crop; but the largeſt quantity is procured from the firſt crop. By ſowing clover ſeed, three or four pounds to the acre, on light loamy ſoils (where you ſow wheat or rye) which yield eight or ten buſhels to the acre, the red clover will not be profitable to mow, but ſtanding thin on the ground, the heads will be well filled with ſeed; theſe fields are kept up the next year till the ſeed is collected; when you perceive about one half of the field to have changed its colour by the drying of the clover heads, you then begin to collect them, which is done by a machine invented at Brookhaven, in Suffolk county. It is drawn by a horſe and guided by a man or boy, who will collect from the field by this means, the heads of clover growing on five acres in one day: the price of collecting is two ſhillings and ſix-pence per acre. This machine is of ſimple conſtruction; it is nothing more than an open box of about four feet ſquare at the bottom, and about two feet high on three ſides; one part, which we may call the fore part, is open; on this part is fixed fingers ſimilar to the fingers of a cradle, about three feet long, and ſo near together as to break off the heads from the clover ſtocks, which are taken between thoſe fingers; the heads are thrown back into the box as the horſe walks on. The box is fixed on an axle-tree, ſupported by two ſmall wheels of about two feet diameter; two handles are fixed to the box behind, by which the man or boy at the ſame time he guides the horſe, lowers or raiſes the fingers of the machine ſo as to take off all the heads from the graſs: as often as the box gets full of heads, they are thrown out, and the horſe goes on again.

Another inſtrument is uſed for collecting hay-ſeed, which is called a cradle; it is made of a piece of

oak board of about eighteen inches long and ten broad; about nine inches of this board, which we may call the fore part, is ſawed into fingers of about nine inches long; a handle is fixed into the board on the back part, almoſt at right angles, inclining towards the fingers; a cloth is put round the back part of the board, which is cut rounding, and raiſed on the handle; this collects or keeps from ſcattering the heads which are ſtruck off from the graſs by this cradle; different fizes are uſed, leſs than the above deſcribed, for women and children, who collect large quantities in this way.

On rich lands ordinarily no ſeed is raiſed from the firſt crop. If the land is highly manured, or otherwiſe very good, the firſt crop of graſs is ſo thick that it yields no ſeed worth gathering: the ſecond crop being ſhorter and thinner, is commonly well ſeeded. Sometimes conſiderable quantities of ſeed is gathered from the firſt crop, on the land where the wheat is cut the ſame year; the ſtubble prevents the clover from growing too thick to produce ſeed.

The ſecond crop of graſs on good land is mowed ſo high as to cut off the heads of the clover, and as little of the graſs as poſſible; a man will mow two or three acres in this manner in a day. The time of mowing is when at leaſt one half of the heads are turned or become dry; it is then raked immediately into ſmall heaps or cocks, of the quantity of about the bigneſs of a large corn baſket.

The machine uſed for collecting this ſeed, and drawn by a horſe, is ſeldom made uſe of in collecting from the ſecond crop; thoſe who do not own a machine, ſuppoſe the expence of hiring, with the loſs of ſeed trod down by the horſe, and levelled with the wheels, being near equal to the expence of mowing the ſecond crop.

All the heads of clover, in what manner ſoever collected, ought to be put into ſmall heaps or cocks in the field, and there expoſed, that the husk may

rot (which generally takes about three weeks in Suffolk county) otherwiſe it will be with great difficulty to get out the ſeed. Some attention ought to be paid to theſe heaps or cocks, leaſt they ſhould rot too much next the ground; it will ſometimes be neceſſary in caſe of much rain to turn the heap; by rubbing the heads in your hand it may eaſily be perceived when the huſk is ſufficiently rotten. Whenever it is found the heaps are ſufficiently rotted and dry, they are carted into the barn, and whenever it is found convenient the ſeed is threſhed out on the barn floor, and cleaned with a wire riddle.

The greateſt yield I have known was one buſhel and four quarts from one quarter of an acre of land —but this produce was extraordinary. This ſeed is ſown in different quantities, according to the richneſs of the ſoil, and the uſe that is propoſed to be made of the graſs. If ſeed is to be collected from the firſt crop, the clover ſeed is generally ſown with the wheat on lands which produce from eight to twelve buſhels by the acre. The graſs on ſuch lands will not be too thick to produce ſeed from the firſt crop. Some farmers inſtead of ſowing the clover ſeed on ſuch grounds at the time of ſowing their wheat, ſow it the laſt of February or the firſt of March, on a light ſnow. If your land be rich, and you mean to ſow the firſt crop and collect ſeed from the ſecond, eight pounds is not too much to put on one acre. If this is all ſown at the time of ſowing the wheat, it may be killed with the winter; if it is not, ſo much graſs commonly injures the crop of wheat; if it is all ſown, the laſt of February or the firſt of March, and a dry ſeaſon ſhould follow, while the roots are young and tender, then the crop of graſs will be loſt. I have found it the ſafeſt way, to ſow one half the clover ſeed propoſed for an acre, at the time you ſow the wheat, and the other half on the ſame land in the laſt of the winter or the firſt of the ſpring.

Some farmers a little before they cart out their dung from their cow-yards to dung wheat, ſcatter the heads of clover all over the yard, ſufficient to ſeed the land they propoſe to dung; the clover heads being trodden into the dung by the cattle, and otherwiſe mixed by carting out, ſpreading and ploughing in the dung, the ſeed comes up exceeding well, and being deeply rooted is not ſubject to injury by drought or froſts. The only objection to this mode is, that the quantity of graſs is apt to hurt the crop of wheat.

OBSERVATIONS *on the* HESSIAN FLY.

By JONATHAN N. HAVENS, *Eſq.*

THE inſect, now univerſally known by the name of the Heſſian fly, was firſt perceived on Shelter-Iſland, and the adjacent parts of Long-Iſland, as far eaſtward as that iſland, a little before the harveſt of the year eighty-ſix, and appeared to have come from the weſt end of Long-Iſland, in a gradual progreſs of between twenty and thirty miles in a year. Before the harveſt in this ſeaſon, the ſpecies appeared to be few in number, but in the fall next following, it was found to have greatly increaſed, and appeared in great numbers on the green wheat, and was obſerved to do moſt injury to that which had been moſt early ſown. At this time the nature of the inſect and its various transformations were very little underſtood by people in that part of the country. It was currently reported in the winter following, that the fly was to be found in great numbers in the wheat in ſheaf; from whence it was concluded that it muſt neceſſarily have ſome immediate dependence upon the wheat in grain, either for food, or in ſome other manner for the preſervation of its ſpecies. This opinion was ſuppoſed to be confirmed by the appearance

of a ſmall quantity of bran which would fall out of many ſheaves of wheat when they were ſhaken; but notwithſtanding this appearance, it was ſufficiently evident, upon a more careful examination, that this opinion muſt neceſſarily be erroneous; and that this inſect, which was affirmed to be the Heſſian fly, could have no relation to that which was found to be ſo injurious to the wheat when growing in the field. Repeated obſervations were made at that time by a gentleman of Shelter-Iſland and myſelf, to aſcertain the fact, whether there was any connexion between theſe two ſpecies of inſects, and whether the inſect which was upon the wheat in ſheaf did in reality any miſchief to the grain. When the ſheaves of wheat were ſhaken, there fell out a ſmall white inſect which very much reſembled the one commonly called a bookloufe; this as it grew larger appeared gradually to turn of a brown colour, and to have wings, but not to undergo any regular transformation like many other ſpecies of inſects; and at laſt it appeared to become a ſmall black fly. There was no other ſpecies except this which could be imagined to be the Heſſian fly, and this did not appear to derive any nouriſhment from the grain; it was moſt probable that it was ſome kind of inſect which was brought in with the wheat from the field, and only harbored during the winter ſeaſon in the ſtraw, and might perhaps have been eaſily diſcovered before if the wheat had been examined. The appearance of bran, which fell from the ſheaves, we ſuppoſed ought rather to be accounted for, as proceeding from mice or weazles, or ſome other cauſe of the like nature. It will be impoſſible in an account intended to be ſo conciſe as the preſent, to relate every minute particular; it was, however, ſufficiently obvious, both from the ſhape of this ſpecies of inſect, and from every other attending circumſtance, that it could have no connexion with the inſect which had been found on the wheat in the field, and this opinion was abund-

antly confirmed by ſucceeding obſervations. In the ſpring of the year eighty-ſeven, the inſect in the field, and which proved to be the real Heſſian fly, multiplied ſo extremely faſt on the green wheat, that at the enſuing harveſt many fields were almoſt wholly deſtroyed; and in the fall of that ſeaſon the wheat then growing ſuffered as great injury as wheat had done before in the ſpring; and the harveſt next enſuing, which was in the year eighty-eight, was cut off almoſt univerſally. The kinds of wheat then moſt generally in uſe among farmers in that part of the country, were the red-bald, and the ſpring or ſummer wheat; both of theſe were equally affected: Rye, the leſs affected in general, was in many places much injured; and what appeared moſt ſingular, was, that a piece of ſummer barley, belonging to the gentleman before alluded to, was about that time wholly cut off. After ſo general a deſtruction of wheat for two ſucceſſive harveſts, farmers began to turn their attention to raiſing rye, and that kind of grain was in general ſown in the fall of the year eighty-eight, except in ſome few inſtances where the bearded wheat had been obtained; and at the enſuing harveſt in the year eighty-nine, the inſect appeared to be gone. In the fall of the year eighty-nine, the ſeveral ſorts of bearded wheat were pretty generally introduced, and the harveſt next following, which was in the year ninety, was in general very fine, and very few of the inſect were to be ſeen. This ſucceſs, which enſued in conſequence of the introduction of bearded wheat, gave great encouragement to farmers, and induced them to ſuppoſe that the raiſing of that ſort of wheat alone, without any other precaution, would in future prove an effectual remedy againſt the deſtruction occaſioned by the Heſſian fly, but experience ſoon after diſcovered this to be a miſtake; for notwithſtanding the uſe of that kind of wheat, the fly again increaſed in the laſt year, ſo as to be found in great numbers in many places, which could be at-

tributed to no other cauſe except this—that the wheat had been ſown ſo early in the fall preceding, as to afford it an opportunity to increaſe. It may not be improper here to remark, that ſowing wheat early in the fall, is a circumſtance very neceſſary to be attended to on Long-Iſland, that the wheat may obtain a good growth before the cold weather, and be leſs liable to be injured by the ſevere froſts which frequently happen in the winter ſeaſon when the ground is not covered with ſnow. From this conciſe view of the firſt appearances, increaſe and decline of this ſpecies of inſect in this part of the country, and its revival again in the laſt year, it will appear, that bald and ſummer wheat will continue and multiply the ſpecies, until the grain is deſtroyed; that on the contrary, rye and the various kinds of bearded wheat will ſoon reduce them to an inconſiderable number; but that bearded wheat alone will not have that good effect unleſs it be attended with the circumſtance of being ſown late; and that the idea which has been pravalent in many parts of the country, that there exiſts ſome principle in the nature of the inſect itſelf, which will cauſe it to decline, or wholly diſappear, in any particular place, after it has prevailed there for three ſucceſſive years, is an opinion which experience has ſhewn to be erroneous; and that the better opinion is, however, unfavorable it may be to the proſperity of our country, that the changes to which the ſpecies is ſubject with reſpect to number, can only ariſe from unfavorable ſeaſons, or from the want of proper food for ſubſiſtence. When this inſect firſt began to prevail in the manner as above related, I conſidered it as a matter of importance to aſcertain its nature and mode of propagation, and the number of generations it paſſed through in a year, and in the two years above mentioned, in which it proved ſo generally deſtructive to wheat, I made a variety of experiments and obſervations on that ſubject; and from ſome of theſe,

I was at firſt inclined to ſuppoſe that there might be three generations of the inſect in a year; but afterwards, upon further examination, it appeared ſufficiently evident that there could be but two; and in this opinion I have been more fully confirmed, ſince I have had an opportunity of making repeated examinations into the nature of the inſect in the laſt year. The reſult of theſe obſervations has been, that the Heſſian fly is an inſect which has no dependence upon the wheat in grain, either for food, or as a place in which to depoſit any nit or egg for the preſervation of its ſpecies; but is in the winter ſeaſon a chryſalis, and remains through the whole winter in the field, on the green wheat, without ſuffering any apparent injury from froſt or ſnow, and is transformed into a fly, as ſoon as the weather becomes warm enough in the ſpring. The time when this transformation will begin, appears to depend upon a certain degree of heat in the atmoſphere continued for ſome length of time, and will therefore vary in the ſame climate or part of the country in different years, according as the ſeaſon in the ſpring of the year may be more or leſs forward, and will very probably, for the ſame reaſon, vary much more conſiderably in different climates or parts of the country in the ſame year; but although this transformation appears to be effected by a certain degree of heat, yet it is far from being univerſal in the whole ſpecies at the ſame time, but continues according to the beſt obſervations that I have been able to make about three weeks. This variety in the time of making this transformation in the ſpring of the year, under the ſame circumſtances with reſpect to heat, and in the ſame ſeaſon, can perhaps be accounted for in no other way than by ſuppoſing that it muſt proceed from ſomething peculiar in the conſtitution of the inſect itſelf; for it ſeems not very probable that it ſhould be occaſioned by the different times in which the inſect may have become a chryſalis in the fall next preceding, after it has

been under the ſnow, and ſubjected to froſt during the whole winter. In the year eighty-ſeven, this transformation began about the ſixteenth of April, and ended about the firſt of May; and this I believe may be conſidered as the uſual time of its commencement and continuance on the eaſtern parts of Long-Iſland, and perhaps on thoſe parts of the continent which are adjacent. The fly diſengages itſelf from the wheat by boring a ſmall round hole through the brown caſe in which it is encloſed, and through the leaf of the wheat juſt oppoſite to the place where it is lodged, and this hole may be eaſily diſcovered as long as the ſtubble remains entire. Whenever the fly has been hatched in the houſe, it always comes forth from its brown caſe, wrapt in a thin white ſkin, which it ſoon breaks and is then at liberty, and there is every reaſon to ſuppoſe that the ſame effect is produced in the field. The fly, very ſoon after it comes out, is prepared to ſpread itſelf in the field where it has lain during the winter, or take its flight to more diſtant places in ſearch of wheat on which to lay its eggs or maggots; and it is at this time that it has an opportunity of going on to ſummer wheat, which would otherwiſe eſcape without being injured. The great variety in the time of its firſt coming out, produces the like variety in the time of its depoſiting the maggot on the wheat, but this I ſuppoſe may be generally placed between the 20th of April and the 10th of May; but this period of time, like the former muſt neceſſarily be regulated, with reſpect to its commencement and continuance, by the ſeaſon; and may perhaps be affected by bad weather and unfavorable winds, which may benumb the fly and prevent it from taking its flight. It is ſuppoſed that the fly in its progreſs from one place to another, and on fields of wheat, is inclined to keep in ſmall ſwarms; and this opinion appears probable from this circumſtance, that ſome fields of wheat are frequently much more injured than others which are not far diſtant,

and the ſame field is frequently injured in ſmall patches whilſt other parts appear in ſome meaſure to have eſcaped. The maggot is properly the firſt ſtate, or mode of exiſtence, with the inſect; for although it appears, at firſt, to reſemble an egg, yet I am inclined to believe that the fly is viviparous, for I never could diſcover that any transformation took place, from an egg to a maggot. It is always found between the loweſt part of the leaf of the wheat, and the part which forms the main ſtalk or ſtraw, to the latter of which it cloſely adheres; and is generally within the outſide leaf, ſo as to lie as near the root as poſſible; but to this there are ſome few exceptions; for it is ſometimes, though very rarely, to be found a little above the upper joints; but inſtances of its being very far from the root are ſo rare, that I never could find but one or two which lay above the higheſt joint. It reſembles at firſt a very ſmall white nit, and as it grows larger, becomes a ſluggiſh, and almoſt inanimate maggot, of a white colour, and capable of very little perceivable motion. In this ſtate, the proper and moſt natural food of the inſect, is the ſap or juice of that kind of green wheat which has the moſt delicate ſtraw; next to this may be ranked the ſeveral kinds of wheat whoſe ſtraw is more firm and ſolid, ſuch as the various ſorts of bearded wheat, and the great red-bald, or red-chaff wheat; and next to this may be ranked rye; with reſpect to barley, I have not had information from different parts of the country, but from the inſtance above recited, I am inclined to believe, that as a food which is agreeable to the inſect, it ought to be ranked with rye, if not before it. Some have affirmed, that the maggot has been found on oats, but I never could diſcover any on that kind of grain. The manner in which the maggot obtains the ſap, or juice of the grain, appears to be altogether by ſuction, which is very probably performed through ſome very fine and imperceptible tubes. It appears deſtitute of any faculty of cor-

roding the ſolid part of the ſtraw; and as it grows larger its whole body indents the ſtraw, and prevents the riſe of the ſap, and the grain either falls down, or periſhes before it has grown to be of any conſiderable height. The ſize of the maggot when full grown, and the time neceſſary to complete its growth, depend in a great degree on the quantity of nouriſhment it may obtain from the grain, and the number of maggots that may happen to be on one ſtraw. This, according to the beſt of my obſervations, is ſomewhere between four and ſix weeks, which will bring the time in which its growth will generally be completed, to be in the firſt part of June. But here the ſeveral cauſes of variety in the time of its being laid in the wheat, and of its completeing its growth, both conſpire to render this time ſo various, that ſome will be full grown, and others transformed into a chryſalis, whilſt others are ſmall; and this circumſtance has no doubt led many ſkilful obſervers to ſuppoſe, that there are two complete generations of the inſect before harveſt. From this account of the maggot it will be obvious, that this is the ſtate in which the inſect deſtroys the grain; for as ſoon as it has obtained its growth, it is transformed into a chryſalis of a dark brown colour, in which ſtate it requires no further nouriſhment, and appears then to do no other miſchief to the grain, than what may ariſe from indenting the ſtraw. The chryſalis is the ſecond ſtate, or mode of exiſtence, which the inſect aſſumes, and is that in which it is moſtly obſerved. It is found in this ſtate in the time of harveſt, and when the grain is gathered, remains in the ſtubble until it is transformed into a fly: But to this there are ſome few exceptions; for thoſe which are ſometimes in the upper joints, and may happen to be ſo high as to be above the ſickle or cradle when the grain is gathered, will of courſe be gathered with it, and muſt always go with the ſtraw, becauſe they adhere too cloſely to it, to be beaten, or threſhed

off, without being deſtroyed. The length of time for which the inſect will continue a chryſalis in the ſummer ſeaſon, is no doubt regulated in a great degree by the quantum of heat which it may enjoy in that ſituation. For this reaſon it is very probable, that in different parts of the country, and in different expoſures to the ſun, this period of time may vary very conſiderably; but though different degrees of heat may produce this effect, yet this muſt be underſtood to be within certain limits; for the chryſalis can endure but a very ſmall degree of heat beyond that which is uſual in its natural ſituation in the field. Beſides theſe effects proceeding from heat, I am inclined, for ſeveral reaſons, to ſuppoſe that different degrees of moiſture will produce effects of a ſimilar nature. 1. Becauſe the chryſalis will periſh, when expoſed to the rays of the ſun, in ſuch manner as to become very dry, and have all its natural moiſture exhaled. 2. Becauſe the fly when hatched in the houſe, where the chryſalis has been kept more dry than in the open air, will always come forth very feeble and will never acquire that life and activity which it muſt be ſuppoſed to have in the field. 3. Becauſe there is reaſon to believe, that too great a degree of moiſture will, in this caſe, produce effects ſimilar to thoſe which muſt ariſe from too ſmall a degree of heat. Although it will prove fatal to the chryſalis, to be expoſed to any degree of heat, beyond that which is uſual in the open air in the ſummer ſeaſon, yet cold and wet, even in the greateſt extremes ever known in our climate in the winter ſeaſon, appear to affect it no otherwiſe, than to continue it in the ſame ſtate, and prevent its transformation into a fly, until it can again enjoy that degree of heat and moiſture which is moſt agreeable to its conſtitution. Theſe circumſtances render it difficult to aſcertain with preciſion, the length of time that the inſect will continue a chryſalis during the ſummer ſeaſon. But from the beſt obſervations I have been

able to make, it is not leſs than two months, and may be prolonged to a much longer time by any of the cauſes before mentioned. All theſe ſeveral cauſes of variety in the time of its continuing in this ſtate, together with the various times in which it is firſt formed into a chryſalis in the month of June, conſpire to render the period of time in which it makes its next transformation into a fly, much longer than any of the other periods of time in which the inſect makes its ſeveral transformations. It generally begins about the 20th or 25th of Auguſt, and continues in a greater or leſs degree through the whole month of September, but by far the greater part of the ſpecies are without doubt transformed into a fly, in the firſt part of this latter month. This appears ſufficiently evident from this conſideration, that wheat, ſown early enough in the ſeaſon to be up in the firſt week in September, will generally be deſtroyed; and on the contrary when it is ſown ſo late as not to be up until ſome time in October, it will in a great meaſure eſcape. I have ſuppoſed this transformation to take place, between the 20th of Auguſt and the 1ſt of October, but this ought no doubt to be underſtood with ſome exceptions; for it is very probable that in ſome few inſtances, and in ſome particular ſituations with reſpect to heat and moiſture, it may begin ſomewhat ſooner; and on the contrary, if the weather ſhould prove moderate in the month of October, there is no reaſon to doubt but that it may continue in ſome degree through the greater part of that month. A reflection will here naturally ariſe from the foregoing account, that nature appears to have fixt this transformation to commence with, and continue through the whole of that ſeaſon of the year, which is moſt proper for ſowing wheat. The fly is the third and laſt ſtate of the inſect, and completes what I have here termed one generation. It very much reſembles the moſchetto, except that it is much ſmaller and has a ſhort bill. I never could diſcover that it

preyed upon the wheat, and very probable that it requires no other nouriſhment than what it may obtain from dew or moiſture. It is of a texture ſo delicate, as to be injured or deſtroyed by the ſlighteſt accident. Soon after it becomes a fly, it again lays the maggot on the wheat ſown in the fall; and if this is not up at the particular time the fly requires it, the maggot muſt be in great meaſure loſt, and the ſpecies reduced to a ſmall number. It is difficult to diſcover for what length of time the inſect will continue a fly in its natural ſituation in the field: in all inſtances where it has been hatched under cover, or in glaſſes provided for that purpoſe, it has ſoon periſhed; and if we may reaſon by way of analogy from the caſe of other inſects, there is little reaſon to doubt, but that the time of its continuance muſt be very ſhort. The maggot generally proves more deſtructive to wheat in the fall of the year than in the ſpring; and before cold weather is transformed into a chryſalis, in which ſtate it is prepared to remain during the winter, and in the ſpring will again be transformed into a fly; which completes two generations of the inſect in one year.

It may not be improper here to mention ſome few experiments and obſervations which I have made on this ſubject; all of which appear to confirm the foregoing opinion reſpecting the number of generations which this inſect paſſes through in a year. A number of the chryſalis gathered from the wheat, about the middle of laſt June, were kept in the houſe in glaſſes, and in a ſituation where they were not expoſed to the rays of the ſun, and a part of thoſe were transformed into a fly between the 10th and 13th of September; and a number of others gathered from the ſtubble after harveſt, and placed in the ſame ſituation, became a fly about the ſame time. The remainder of thoſe, which were not transformed into a fly at that time, continued in the ſame ſtate until the weather became too cold for

them to make their transformation. In the year eighty-ſeven, I made experiments of a ſimilar nature, with only this difference, that the chryſalis was expoſed to the rays of the ſun in ſuch manner that the heat would not be too violent, and in this caſe, a few of them were transformed into a fly, as early as the middle of Auguſt. It muſt however be obſerved, that in all experiments made in this manner, there is reaſon to ſuppoſe ſome degree of uncertainty, becauſe the chryſalis is removed from its natural ſituation: for this reaſon I have always ſuppoſed, that the beſt method to arrive at truth on this ſubject, is to examine the progreſs of the inſect in the field; and with this view I examined the ſtubble of a field of wheat, where great numbers of the inſect were to be found, as often as twice in a week, from the 1ſt of September until the 14th of November in the laſt fall, and found them continually to diminiſh in number, but that there were ſtill ſome few of the chryſalis remaining. Theſe I have ſuppoſed muſt either be conſidered as ſome few which were anomalous, and never intended by nature to undergo any transformation; or elſe it muſt be concluded, that many of thoſe which become a chryſalis late in the month of June, will remain in that ſtate for ſo long a time, that the weather will become too cold for them to be transformed into a fly in the fall, and then they muſt neceſſarily continue in that ſtate through the winter, until it becomes warm enough in the ſpring: and if this latter concluſion be conſiſtent with truth, it will follow, that ſo far as reſpects theſe, there can only be one generation in a year. It is an opinion entertained by many, that there are three generations of this inſect in a year; but in anſwer to this, I ſhall only obſerve, that independent of what has been before ſaid on this ſubject, this opinion muſt appear improbable from this conſideration—that if we ſuppoſe three generations in a year, it will follow, that the inſect will be twice

a fly before harveſt, and the ſecond time of its being a fly muſt happen when the wheat is in the milk, or very near it; at which time it is ſo large and rank, and ſo ſoon after changes its colour and becomes dry, that the maggot which muſt then be laid in it, would not have ſufficient time to complete its growth, and would therefore periſh, and in the fall of the year the inſect would diſappear. Others are of opinion, that there is ſo great a variety in the transformations of this inſect, that it may be found in all its different ſtates, at all times in the year, excepting in the cold weather, or in the ſpring. From what has been before obſerved on this ſubject, it appears, that this opinion may very probably be true, ſo far as it reſpects the month of September, and a part of October, and poſſibly with reſpect to the latter part of May, if the fly, which is hatched in the ſpring, ſhould continue until that time; but cannot be applied with propriety to June and July, in which months I have ſuppoſed that the inſect does not exiſt in the ſtate of a fly. It is probable that this opinion may have ariſen from theſe circumſtances; that there are ſeveral ſpecies of gnats, or flies, which may very eaſily be miſtaken for the Heſſian fly; and that in examining wheat, to diſcover whether the inſect is transformed into a fly, it is very difficult to diſtinguiſh the ſhells of the chryſalis which have lain in the wheat during the winter, from thoſe of the next generation which has ſucceeded them in the ſpring and ſummer following; and this latter circumſtance, without great care, will be a ſource of perpetual miſtake and error to thoſe who may examine into the nature of the inſect, and is perhaps one of the greateſt obſtacles to arriving at certainty on this ſubject.

Of all the various methods which have been propoſed to the public, for preventing the injurious effects of this inſect, that of raiſing the different ſorts of bearded wheat has beſt ſucceeded. This kind of

wheat having a more ſolid ſtraw than the bald wheat, reſiſts the impreſſion made by the body of the inſect, and in a great meaſure prevents the injury which ariſes from preventing the riſe of the ſap; and for the ſame reaſon is very probably more diſagreeable to the conſtitution of the inſect. During the laſt year, I had an opportunity of making one fair experiment, to determine whether any preference ought to be given to any one of the different ſorts of wheat, whoſe ſtraw is more firm and ſolid than the bald wheat. I ſowed three different ſorts of wheat, adjoining to each other, and all at the ſame time; the white bearded, the yellow bearded, and the great red-chaff wheat, whoſe ſtraw is equally hard with that of the bearded wheat; of theſe three ſorts, the red-chaff was by far the moſt injured; and the yellow bearded which lay adjoining to it, leaſt of all.

I ſhall now take the liberty of ſuggeſting a method of deſtroying the inſect, which naturally occurred to my mind, on obſerving that it is not to be found in any other ſtate than that of a chryſalis in the time of harveſt, and that it remains in that ſtate in the ſtubble for ſometime afterwards; and that is, *to deſtroy the ſtubble of grain ſoon after the harveſt.* Whether this would be beſt effected by burning or otherwiſe, and when the grain in this caſe ought not to be cut with the ſickle rather than mowed or cradled, and whether the coſts that would attend it would not overbalance the advantage, are points to be taken into conſideration in determining whether any thing of this kind would be feaſible, and which I ſhall not now pretend to diſcuſs; but if the ſtubble of wheat were to be univerſally burnt, turned over with the plough, or deſtroyed in any other manner, ſoon after harveſt, and this were to be done for ſeveral years together, I have little doubt but that it would prove an effectual mean of deſtroying the whole ſpecies: I here mention only the ſtubble of wheat, becauſe it is not very probable that the ſpe-

cies would be continued long on rye, more eſpecially as that can be ſown much later than wheat, without injury from the winter; but the ſtubble of rye might, if neceſſary, be as eaſily deſtroyed as that of wheat; and if in aid of this the beſt ſort of bearded wheat were to be uſed, and that to be ſown as late as poſſible conſiſtent with a good crop, it would be ſtill more likely to ſucceed. With reſpect to the probability of their being imported from any foreign country, I ſhall make only one remark, that from the foregoing account it appears evident, that they may be removed from their natural ſituation in the field, and be kept alive long enough to be carried acroſs the Atlantic; from which circumſtance it appears poſſible that they might have been imported in ſtraw or ſtubble. It has been generally remarked, that in ſpreading over the country they go between twenty and thirty miles in a year; but as they are a fly twice in the ſame ſeaſon, it appears probable, that the fly itſelf never goes much farther than twelve or fifteen miles. Before this ſubject is concluded, it ought to be remarked, that the truth of what has been here ſaid concerning the nature of this inſect, and the ſeveral generations through which it paſſes in a year, does not entirely reſt on my own particular experiments and obſervations, but has been corroborated by the obſervations and experiments of the gentleman, to whom I have before alluded in treating on this ſubject. How far this account may have been confirmed, or contradicted by others who may have obſerved the various phenomena of the inſect, I am not able to ſay; but if it ſhould appear upon further inveſtigation, that what has been here advanced is erroneous, it ought to give me and every other lover of truth, great pleaſure to ſtand corrected, on a ſubject of ſo much importance to the public.—It has been before obſerved, that the ſureſt way of arriving at truth on this ſubject, is to examine the progreſs of

the inſect in the field ; and to carry this into effect, I would ſuggeſt the following method : Let thoſe who may have leiſure and curioſity on this ſubject, and who may reſide in different parts of the country where the inſect may prevail, ſow ſmall patches of different kinds of wheat, as often as once or twice in a month, during the whole ſeaſon, adjoining to ſome field of wheat or ſtubble, where the inſect may be found in greateſt number ; and let the progreſs of the inſect be obſerved on thoſe different patches of wheat ; and let the reſult of theſe obſervations be collected and compared with each other ; this, if it could be carried into effect, I have conceived would be the ſureſt method of arriving at certainty on this ſubject, and perhaps ſomething not now thought of might be diſcovered, which would prove an effectual remedy againſt the injurious effects of this inſect.

Obſervations on the Drilling of Wheat.

By WALTER RUTHERFORD, *Eſq.*

GENTLEMEN,

AS I conſider wheat as the firſt ſtaple of the trade and wealth of the middle ſtates, I beg leave to recommend a method of promoting this article, without adding to, but rather diminiſhing, the expence of culture.

The drill huſbandry has been long recommended and practiſed in England, but in a manner ſo complicated, machinery ſo expenſive, and ſucceſs ſo various, that it has never come in general practice there, nor attempted in that method in America ; but ſome years ago a farmer in Somerſet county, in New-Jerſey, firſt introduced a ſeed-drill of his invention. Being a ſeed-box over a cylinder that turns with the wheels, with four holes in the box, that anſwer notches ſloped in the cylinder, by

which the ſeed falls into drills at thirteen inches apart, which machine is drawn by a pair of horſes, with a tongue to turn it ; when turning, the wheel to be held faſt, and bringing the wheel to run in the outſide drill ; and afterwards drilling the head-lands, the whole field will be drilled at thirteen inches apart, and may put in about eight acres a day, being underſtood to be well harrowed before drilling.

The advantages of this method is found by the experience of many farmers to be, 1ſt, It takes ſomewhat leſs ſeed—2d, The ſeed is much better covered—3d, The ridges on each ſide mouldering gradually on the green grain, prevents it from freezing out, or being winter killed—4th, It is ſheltered from the bleak ſpring winds—5th, It drains off the wet—6th, it better ſtands the drought, the roots being well covered.

Where the land is richly manured, perhaps this method may not be ſo neceſſary ; and if the fallow is covered with large ſtones, or ſtumps of trees, it will be impracticable ; but on land conſiderably exhauſted, our farmers have experienced great advantage ; I reckon it yields about a third more—my neighbor, a judicious farmer, thinks it yields him double the old method. When I firſt practiſed this way, it was on a field that the year before was in ſummer grain ; one part of it gave a much better crop than the reſt ; without directions, the teamſman ſowed this part by hand ; moſt certainly the crop proved to be the worſt part of the field, which many of the neighbors viewed, and next year began, and in general have followed this practice. Our carpenters deliver this drill compleat for eight dollars.

New-York, Feb. 28, 1792.

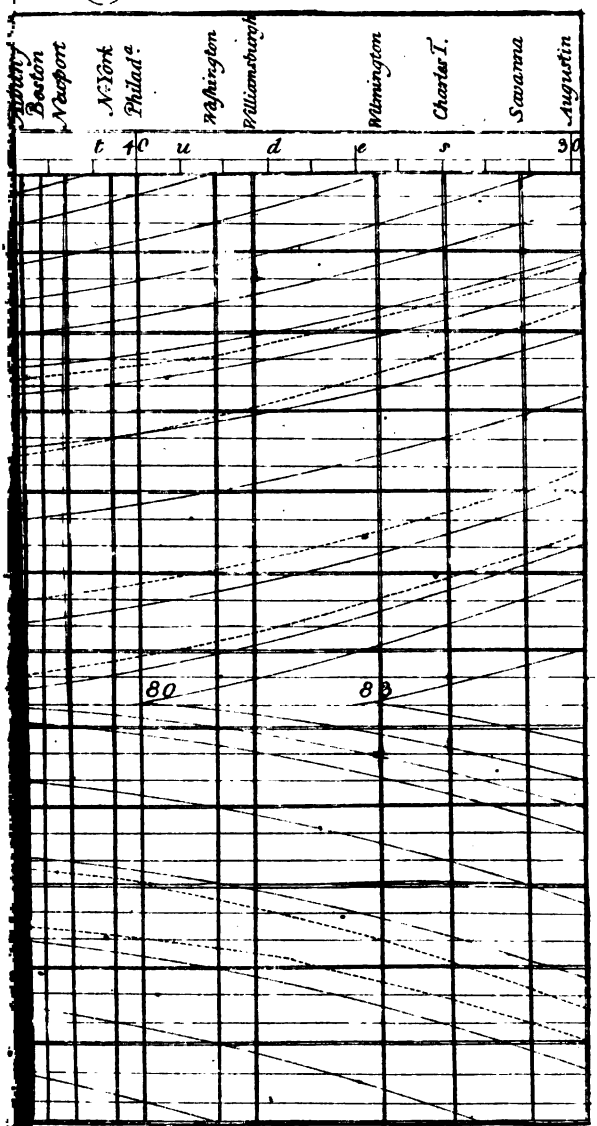
Reſpecting a Plan of a Meteorological Chart, *for exhibiting a comparative view of the* Climates *of* North America, *and the progreſs of* Vegetation, *by* Simeon De Witt, M. A. P. S.

IT will not be denied that it is a deſideratum, of no ſmall moment, in practical agriculture, to be enabled to aſcertain, with as much preciſion as the nature of the caſe will admit, the relative degrees of heat and cold, and of the progreſs of vegetation, through the ſeaſons, in the various climates of America, and ſo to arrange them, as that they may be obſerved in the readieſt manner. Without adducing any other reaſon, a ſingle reflection will convince one of its utility; for, as the ſtate of vegetation is very different in different climates at the ſame time, without knowing what allowances are to be made on this account, the farmer, in one climate, will not be able properly to apply to his practice the experiments on huſbandry made in another; and unleſs the reſult of the obſervations, from which this knowledge is to be deduced, be conveniently arranged, one will be neceſſitated to rumage through a confuſed heap of meteorological tables, collected from various quarters for a ſucceſſion of years; a buſineſs too difficult to prove generally beneficial. It is in ſome meaſure owing to this cauſe, that we profit ſo little by books of huſbandry written in Europe.

To obviate theſe inconveniences is the deſign of the plan which I have the honor of preſenting. The requiſites for conſtructing it will be, beſides the common obſervations on the weather, obſervations on the annual commencement, progreſs, maturity and decay of vegetation, made in various parts, for a number of years; the averages whereof may be taken for ſtandards by which to exhibit a compariſon of climates.

To effect this deſign, I would propoſe that the different ſocieties on the continent, which compriſe

ative view of the Climate
n (De Witt) MAPS.



Re

I
bl
tu
he
th
ri
o
a
o
d
o
a
p
h
o

agriculture among the objects of their inſtitution, be requeſted to co-operate.

The remarks on vegetation ſhould commence with the firſt appearance of it in the ſpring, and be made on graſs in general, the budding of trees, the flowering of plants, the maturity of the ſeveral kinds of winter grain and fruit, and the falling of leaves, and other ſymptoms of decay, in the fall. In theſe obſervations a preference ſhould be given to thoſe vegetables which are of the moſt valuable kind, and to others which are known to be common to all the places where the obſervations are made. Cultivated annuals, the ſeeds of which are planted or ſown in the ſpring, ſhould be entirely omitted, as their forwardneſs depends principally on the degree of care beſtowed upon them. In general, the Linnean, as well as the vulgar names, ſhould be given, ſince the latter are well known to differ in many inſtances, even in ſtates adjoining each other, and therefore might lead into error. After a ſufficient courſe of obſervations is completed, ſuch vegetables as will beſt anſwer the purpoſes intended, may be ſelected for the meteorological chart.

A mean between the extremes of heat and cold within the twenty-four hours, which I think will be beſt determined by the ſtate of the thermometer at or before ſunriſe, and the middle of the afternoon, ſhould be taken for the temperature of the weather. Perhaps it would not be amiſs alſo to note the firſt appearance and diſappearance of birds of paſſage, particularly the ſwallow, as a criterion by which to judge of the advanced ſtate of the ſeaſons.

Explanation of the Chart.

At the head of the chart, on the right hand ſide, are to be the names of the places, where the obſervations are made, oppoſite to their reſpective latitudes, expreſſed on the graduated ſcale immediately below them; from each place a line is drawn perpendicu-

larly downwards. The large ſpace on the left, is for the remarks on vegetation, oppoſite to the ſeveral months in which they occur. The next column is divided into months, and its ſubdiviſions, carried by ſtraight lines horizontally acroſs the chart. In the next column the mean degrees of heat, taken from Farenheit's thermometer, are to be inſerted for every ten days throughout the year; from each of which, curve lines are to be drawn, in ſuch a manner, as to interſect the perpendicular lines of the ſeveral places oppoſite to thoſe times reſpectively, in the column of months, of which they are of the ſame temperature. Perhaps it would be of uſe to have three columns, inſtead of one, for the thermometer; one to receive the mean of the morning obſervations, the other the mean of the afternoon obſervations, and the third the mean of the two others. In the ſame manner, dotted lines are to be drawn, to ſhew at what times any of the phenomena of vegetation occur at different places. The neceſſity of this diſtinction ariſes from the circumſtance, that the thermometer and vegetation do not exactly keep pace with each other.

Farther to illuſtrate the uſe of this chart, let it be required to find what time at Williamſburgh correſponds in temperature with the firſt of May at New-York. In the perpendicular line of New-York, take that point which is oppoſite to the firſt of May, and from thence follow the direction of the *black* curve lines, till you interſect the line of Williamſburgh, and the place in the column of months to which you are oppoſite, will expreſs the required time. Again, let it be required to find when wheat is ripe at Williamſburgh—In the column of remarks ſee the figure annexed to that remark, which expreſſes the day of the oppoſite month; and from that part of the month follow the direction of the *dotted* lines, till you interſect the line of Williamſburgh, and the time will be ſhewn in the column of months oppoſite to it.

It is a fact well known, that the weſtern parts of this country do not correſpond in climate, with thoſe

lying in the ſame latitude along the ſea coaſt. If, therefore, ſuch a chart be conſtructed, from obſervations made in places near the Atlantic, correſpondent obſervations made in the interior parts of the country, will enable us to aſcertain to what latitude in the chart they are to be referred.

If a diſtinct chart were conſtructed, on the ſame plan, for the principal places in Europe, one might with equal facility, by the help of both charts, compare their climates with thoſe of America.

It is to be obſerved, that the plan which I have produced, muſt be conſidered as a mere deſign, as I have but lately taken up the idea, and have no materials at preſent before me, from which I might make an attempt to come any way near to the truth; but I truſt it is repreſented ſufficiently plain to ſhew its nature and uſe, and that the advantages of it will, at firſt view, appear of ſuch importance, as to engage ſcientific gentlemen to collect and contribute materials for perfecting it.

RESULT *of* THERMOMETRICAL OBSERVATIONS *for the year* 1790, *made at the city of New-York.*

1790.	Mean degrees at 8, A. M.	Mean degrees at 2, P. M.	Mean degree of the month.	Greateſt cold in the month		Greateſt heat in the month	
January	31°	35°	33°	6th day	20°	4th day	54°
February	28	32	30¼	10	9	28	46
March	34	40	37	9	6	17	55
April	42	49	45½	7	33	4	65
May	56	65	60½	1	45	24	74
June	65	71	68	11	57	17	80
July	69	76	72½	1	64	5	81
Auguſt	70	75	72½	20	64	14	85
September	62	68	65	24	54	2	79
October	51	57	53½	27	39	4	71
November	41	45	43	26	29	1	56
December	23	27	25	19	10	12	38

Mean Degrees of Farenheit's Thermometer for every ten Days of the Year 1791.

	at 8 A. M.	at 2 P. M.	Mean.
January	26	32	29
	28	32	30
	27	31	29
February	27	31	29
	26	30	28
	30	32	31
March	33	39	36
	38	42	40
	41	47	44
April	42	48	45
	46	56	51
	52	60	56
May	53	59	56
	58	66	62
	65	73	69
June	67	73	70
	70	78	74
	70	76	73
July	68	74	71
	72	82	77
	73	81	77
August	73	79	76
	70	76	73
	72	80	76
September	64	68	66
	63	67	65
	63	67	65
October	55	63	59
	46	54	50
	45	51	48
November	42	48	45
	39	43	41
	37	45	41
December	30	34	32
	31	37	34
	26	34	30

PART II.

INTRODUCTION.

Correſpondence between the Preſident of the Society, and the Preſident of the Chamber of Commerce, reſpecting the Introduction of Plants and Animals from foreign Places.

New-York, 5th Dec. 1793.

SIR,

THE legiſlature having, with a view to commercial and agricultural intereſts, been pleaſed to incorporate your chamber, and the ſociety for the promotion of agriculture and uſeful arts, over the latter of which I have the honor to preſide, it becomes our duty mutually to forward their views in the formation of theſe corporations. There can be little doubt that the profitable commerce of this country muſt be founded upon its agriculture, and that its agriculture derives new vigor from the extention of its commerce. In theſe views, our intereſt and that of the ſtate are too cloſely connected to permit me to doubt the readineſs of the reſpectable corporation over which you preſide, to attend to every object which may intereſt our agriculture; nor will they, Sir, I truſt, find any difficulty in believing that the agricultural ſociety will cheerfully embrace every means that they ſhall ſuggeſt for extending the commerce of this ſtate. The requeſt which I am now to make, on the part of the ſociety in which I preſide, will indeed rather be a tax upon the public ſpirit of the members, individually, than upon

the chamber; but it is a tax which I am ſatisfied that they will readily pay, if it meets the approbation, and is recommended by the corporation. In this perſuaſion, I incloſe a draft of general inſtructions for captains of veſſels ſailing in the employ of the members of your chamber, with a requeſt on the part of the ſociety, for the promotion of agriculture and uſeful arts, that they may, under the patronage of the chamber of commerce, be recommended to their care and attention. Not having yet had any opportunity of conſulting the ſociety on this ſubject, I ſhall hold myſelf perſonally bound for any reaſonable expence that may be incurred. If the chamber of commerce ſhould adopt the inſtructions, with any alterations that they may deem proper, the ſecretary of the agricultural ſociety, Samuel L. Mitchell, Eſq. on their being ſent to him, will have a number of copies printed and diſtributed to the members of your ſociety, who will be pleaſed to give them, or ſuch of them as they may reſpectively approve, in charge of the captains of their veſſels, and direct them to be ſtuck up in their cabbins.

I have the honor to be, Sir,
With much conſideration and eſteem,
Your moſt obedient humble ſervant,

ROBERT R. LIVINGSTON.

John Broome, Eſq. Preſident of the Chamber of Commerce.

At a ſtated Meeting of the NEW-YORK CHAMBER *of* COMMERCE, *held at their Chamber the 7th of January*, 1794.

A COMMUNICATION of the ſociety for the promotion of agriculture and uſeful arts, by letters from Robert R. Livingſton, Eſq. preſident, and Samuel L. Mitchell, Eſq. ſecretary, was read, and the object of that communication being approved, it was, upon motion, reſolved—

That the corporation of the chamber of commerce of the ſtate of New-York, in the United States of America, recommend a compliance with the following inſtructions, to all captains of veſſels ſailing from this port to Aſia, Africa, the north of Europe, or the ſouthern or weſtern parts of North-America, as far as may be done with perfect ſecurity to the property and intereſt of their owners; and that they may cauſe a fair printed copy thereof, with which they will be furniſhed, to be ſtuck up in their reſpective cabbins.

By order of the Chamber,

JOHN BROOME, Preſident.

Atteſt. WM. LAIGHT, Secretary.

INSTRUCTIONS *to Captains of Veſſels ſailing to any part of Aſia, Africa, the North of Europe, the Southern or Weſtern parts of North-America.*

Firſt. PROCURE a ſmall quantity, not exceeding one quart, of thoſe kinds of grain which make the principal food of the inhabitants, and this even though it ſhould be wheat, barley, rye, oats, or maize; for though thoſe grains are common in this country, yet there are varieties which may be extremely important, as was inſtanced in the accidental introduction of the white bearded wheat, which was found to reſiſt the inſect when every other ſpecies was deſtroyed by it.

Second. Procure alſo ſmall quantities of the ſeeds of thoſe kinds of pulſe and legumens which are of any eſtimation in the opinion of the inhabitants of the country you viſit, with inſtructions for their proper cultivation, of which a minute ſhould be made upon the ſpot.

Third. In countries where the rigor of the climate compels the inhabitants to procure dry food for their cattle in the winter, inquire what that food is, whether hay, grain, or roots: obtain ſeeds of the ſpecies

of graſs from which they make their hay, if not ſimilar to that in common uſe here; and a ſmall quantity of the grain and roots, with the modes of cultivation. Procure the ſeeds and ſtones of ſuch fruits as ſhall appear to you of importance to this country, or which are not known here, tropical fruits only excepted, ſince there is little proſpect of their ſucceeding in this climate. This exception is not, however, to apply to annual fruits, ſince they may probably ſucceed here.

Fourth. Remark any differences that may diſtinguiſh the cattle, either uſed for food or draft, in the country you viſit, from thoſe found here; make notes of the variance, and communicate your obſervations to the preſident or ſecretary of the agricultural ſociety, in order that if any advantage ſhould reſult from their introduction, the ſociety may take meaſures to import them.

Fifth. Be particularly attentive to the breed of ſheep, and whenever they ſhall appear ſuperior to thoſe of this ſtate, either in ſize, or in the *fineneſs* or the quantity of the wool proportioned to the ſize of the ſheep (for ſmall ſheep may be very valuable if their fleeces ſhould be fine) to import if poſſible a pair of them, or a ram at leaſt, particularly if you ſhould be able to obtain the ſheep of Spain or Barbary, which are amongſt the moſt valuable, even though they ſhould not appear to you ſuperior to thoſe of this country. Sheep from China would alſo be deſirable, as would thoſe of the fine wool kind from India, Angora, and other parts of Aſia. There is alſo a ſpecies of fine white long haired goat in Africa, the ſkin of which is uſed for muffs; it would be deſirable to procure a pair of theſe if it could be conveniently done.

Sixth. South-America affords a ſpecies of ſheep (the Vigone or Peruvian ſheep) which if introduced and found to ſuit the climate, would be an invaluable treaſure. From the ſame country, the Gulph of

Mexico, and the Bay of Honduras, Cayenne, &c. may be brought the Pecari, which is a ſmall and ſingular ſpecies of wild hog: This may, on experiment, be found worth while to domeſticate here, if a pair of them could be conveniently procured.

Seventh. If any land or water fowl, not known in this country, ſhould be domeſticated in the country you viſit, you will procure a few of them; amongſt which may be remembered the Hoco of the Brazils and Cayenne. It is nearly of the ſize of a turkey, black, and frequently domeſticated. It is known by various names.

P. S. You will obſerve that it is not expected you ſhould bring any ſheep from England or Ireland, or any other country from which the exportation is prohibited, as you are on no account to incur any perſonal riſk, or hazard the property of your owners.

New-York, February 10, 1794.

SIR,

AT a meeting of the Chamber of Commerce next after the receipt of your letter of 5th December, I did myſelf the honor to lay it before them, together with the inſtructions to captains of veſſels, ſailing to any part of Aſia, Africa, the North of Europe, the Southern or Weſtern parts of North-America; and at the ſame time recommended them to their patronage, with which they cheerfully complied: A copy of the reſolution of the chamber thereon, together with the inſtructions I have ſent to Mr. Mitchill, ſecretary to the agricultural ſociety; wiſhing the laudable end you thereby propoſe, may be fully anſwered,

I have the honor to remain,
With great conſideration and regard,
Sir, your moſt obedient ſervant,
JOHN BROOME.

Hon. ROBERT R. LIVINGSTON, *Eſq.*

TRANSACTIONS, &c.

Addreſs to the Society, in conſequence of their Requeſt, during the Abſence of Mr. Juſtice HOBART, *who had been appointed to deliver the Annual Oration.*

By ROBERT R. LIVINGSTON, Eſq. Preſident.

AN honorable member having long ſince been requeſted to deliver an oration to the ſociety, it is not without regret that I reflect on the circumſtances that have hitherto prevented his executing that duty; his experience in agricultural knowledge would have given us reaſon to hope for much intereſting and uſeful information, which will be illy ſupplied by the haſty production which, in obedience to this late command, I now ſubmit to the ſociety.

It will not be expected, I preſume, that I ſhould long detain you attention by a lengthened panegyric upon agriculture, ſince you have ſhewn the opinion you entertain of its importance, in the very act of becoming members of a ſociety, whoſe object it is to improve and extend this uſeful ſcience.

As agriculture is the baſis of arts, by furniſhing the materials upon which they work, ſo it is the parent of ſcience, by uniting men in civil ſociety, who without its aid would have continued to be wandering ſavages, but little advanced in improvement beyond the beaſts of the foreſt, that afforded them a miſerable and ſcanty ſubſiſtence. It is for this reaſon that the mythology of moſt nations have made their golden

age conſiſt in the enjoyment of rural happineſs, and placed the inventors of agricultural improvements among the number of their Gods: Thus Ceres, Pan, Pomona, &c. were worſhipped under different names by all the civilized nations of the Pagan world. And our own holy religion teaches us that the cultivation of a garden, and the enjoyment of its fruits and flowers, were the employment and reward of innocence when man was moſt perfect. It is a little remarkable that innocence and reaſon ſtill concur in receiving pleaſure from the ſame object. The firſt wiſh of childhood is rural happineſs; nor is that ever loſt ſight of, except where ſome turbulent and reſiſtleſs paſſion depraves and hurries away the ſoul. In every period of life it animates virtuous and ingenuous minds. The idea of a rural retreat in the evening of his days, accompanies the mechanic to his ſhop, the merchant to the exchange, the lawyer to the bar, the phyſician to the ſick bed, and the divine to the pulpit, who ſees, even there, his earthly paradiſe upon the confines of heaven, and hardly wiſhes to enter the celeſtial manſions by any other path. How much then is it to be lamented that indolence or purſuits of little moment, withdraw the attention of men, whoſe lights, whoſe talents for obſervation, and whoſe fortunes enable them to be uſeful, not only to the community of which they are members, but to mankind at large—not to their cotemporaries only, but to future generations: One great cauſe of the neglect of agriculture in men of the character I have mentioned, is a miſplaced ambition which generally ſeizes upon them at the very period of life at which they are beſt fitted for agricultural purſuits. Youth has too many avocations, and is too unſteady to purſue the ſlow progreſs of experiments, and the decrepitude of old age deprives it of the ſtrength and activity neceſſary in rural economy; it is the ſeaſon of life in which we may enjoy the ſedate pleaſures of the country, but not undergo its toils. The middle age,

when the effervescence of youth is over, when the body retains its ſtrength, and the mind enjoys its greateſt vigor, is the period beſt adapted to the uſeful labors of agriculture; but unfortunately this is alſo the age of ambition which hurries us away from the peaceful path, where every ſtep is ſtrewed with flowers, to loſe ourſelves in the endleſs mazes of politics. And yet if ambition is the love of fame, how much are we deceived by purſuing it in this rough and thorny track? The little politics of our town, our county, or even of our ſtate, are mere matters of a day; and however important they may ſeem in our eyes, while we are ourſelves the actors on this buſy ſtage, they will appear to others of too little moment to arreſt their attention. Our fathers were politicians, their fathers were politicians, and yet we hardly know the parts they ſeverally acted, or even the names or principles of the parties they oppoſed or ſupported. In like manner the intriguing politicians, and the wordy orators of the preſent day, will be buried with their principles and their parties in eternal oblivion, when the man who has introduced a new plant, or eradicated a deſtructive weed, who has taught us to improve our domeſtic animals, or to guard againſt the ravages of noxious inſects; who has invented a new implement of huſbandry, or ſimply determined the angle the mould-board ſhould make with plough-ſhare, will be remembered with gratitude as the benefactor of ſociety.

It is the politicians misfortune to believe that every thing is wrong which he does not direct, and that the ruin or welfare of the ſtate depends upon the adoption of his principles; and yet the world was governed before he was born, and will be ſo well directed after his death, that his preſent political exiſtence will hardly be remembered one week after his funeral. As the purſuit of fame by the road of politics, requires infinitely more talents than falls to the ſhare of the great bulk of mankind, and great epochs or

extraordinary circumſtances to call thoſe talents into action, but very few can hope for political fame, while their purſuits have a direct tendency to injure the fineſt feelings of the mind, and to add poignancy to the moſt painful paſſions.

The thorough-paced party-politician concurs in many meaſures that he does not approve, he confides in men that he ſecretly deſpiſes—he oppoſes the meaſures of his antagoniſt, though his reaſon tells him they are proper—His ſins of omiſſion and commiſſion daily ſtare him in the face, and if ever he finds time to pray, he muſt confeſs in the words of the Common Prayer, "That *he has done thoſe things which he ought not to have done, and left undone thoſe things which he ought to have done;*" while with a diſtruſtful eye he is compelled to guard againſt the defection of his partizans, he indulges the moſt rancorous reſentment againſt his antagoniſts: thus, jealouſy and hatred, thoſe painful paſſions, are nouriſhed like the vulture that feeds on the liver of Prometheus, to prey on his vitals. Rural life is exempt from theſe evils. The huſbandman hates no one, becauſe he dreads no rival. If his neighbor's field is more productive than his own, he borrows a uſeful leſſon, and turns his proſperity to his own advantage: Two important maxims are ever in his mind—Firſt, that the earth yields nothing to the idle and the negligent—Second, that though labor will do much, yet the return it meets will often depend upon circumſtances which it is not in his power to command—He is therefore at once ſatisfied with the neceſſity of uſing the *means*, as the divines ſay, and of his dependance on the Supreme Being for crowning them with ſucceſs; thus reconciling (at leaſt in an earthly ſenſe) the intricate doctrines of *works* of *grace*. The conſtant attention that the farmer is compelled to give to the wants of his domeſtics, and to the animals under his care, render him habitually compaſſionate, humane and careful; and, if happineſs is to

be found on earth, it muſt certainly be ſought in the indulgence of theſe benign emotions. As Cicero ſums up all human knowledge in the character of a perfect orator, ſo we might with much more propriety claim every virtue, and embrace every ſcience, when we draw that of an accompliſhed farmer. He is the legiſlator of an extenſive family, and not only men, but the brute creation, are ſubjected to his laws —He is the magiſtrate who expounds and carries thoſe laws into execution—He is the phyſician who heals their wounds, and cures the diſeaſes of his various patients—He is the divine who ſtudies and inforces the precepts of reaſon—And he is the grand Almoner of the Creator, who is continually diſpenſing his bounties not only to his fellow mortals, but *to the fowls of the air, and the beaſts of the field.*

I was led into theſe reflections by finding myſelf ſurrounded by gentlemen who are not leſs capable of rendering their country ſervices in the promotion of agriculture and uſeful arts, than in their reſpective political ſtations.—I wiſhed to convince them that at leaſt, as much reputation, with more permanent fame, might be acquired in the firſt than in the laſt of theſe purſuits ; and yet to the diſgrace of this ſtate it has ſo happened, that though it has always poſſeſſed men of diſtinguiſhed talents, the rage for party politics and diſſipation, have defeated every attempt to eſtabliſh any ſociety for the promotion of arts, agriculture, or any literary or ſcientific object : how many now hear me who are capable of wiping off this reproach—who have ample means of doing honor to the ſtate, by promoting that of this ſociety, but who have yet offered it no aid ! The exertions of a few friends to uſeful knowledge, have enabled us to ſtruggle through three years : And I would fain hope that many now preſent will ſtep forward to our future ſupport.

I proceed to diſcuſs the ſubject which I particularly deſigned to ſubmit to the conſideration of the

ſociety ; I mean the compariſon between the advantages of agriculture in Britain, and in this ſtate. I am well aſſured that falſe conceptions on this ſubject have led many theoretical farmers into important errors. The inhabitants of every part of the world (our own excepted) entertain ſtrong prejudices in favor of their native country : here, on the contrary, the people are habitually led to form exalted ideas of Britain, and degrading ones of America.—I do not remember that this ſingular circumſtance has been obſerved or accounted for. The ſettlers of this country conſiſted originally of emigrants from various parts of Europe, but principally from the Britiſh iſles. Though their practice ſhewed their preference, yet they could not diveſt themſelves of this prejudice in favor of their native country. And that prejudice, as was natural, was increaſed by the diſtance and the hardſhips to which their change of ſituation expoſed them ; it was ſtimulated into exerciſe by the vanity of raiſing themſelves above their neighbors, for every man ſuppoſes he borrows a certain degree of conſequence from the ſuperiority of his country. Thus an Iriſh, a Dutch, and a Britiſh emigrant, ſettled in the neighborhood of each other, would boaſt the ſuperiority of their reſpective countries ; would conceal their defects, and exaggerate their advantages ; and diſagreeing in every thing elſe, would unite in admitting the inferiority of America to Europe, that tie which connected them with each other ; their children and neighbors having no means to contradict explicitly, credited theſe tales, and felt themſelves inferior to theſe boaſting natives of a diſtant land ; their deſcendants endeavored to ſhare in the honor of their parents, by recording their deſcent from ſuch illuſtrious anceſtors ; and gloried in diſſeminating falſe ideas of countries of which they had no other knowledge except through this ſource, and from other boaſting and conſequential travellers.—It is true theſe prejudices

are wearing off, yet there are few perſons who do not even now conſider the ſoil and climate of Britain as ſuperior to that of this ſtate, when the fact is directly the reverſe. The proportion of land unfit for cultivation in the iſland of Great Britain, is much greater in compariſon to the whole quantity, than it is in this ſtate—The ſoil is leſs productive, except where great labors are beſtowed in cultivation; and the climate in many reſpects leſs friendly to agriculture. I aſſert this from a careful examination of the beſt Engliſh writers on the ſubject, and particularly from Young and Marſhal, who are much better authority than the aſſertions of emigrants, that for the moſt part have given little attention to the ſubject, or judge of the whole kingdom from a fertile or highly cultivated ſpot in their neighborhood.

Let us now deſcend to particulars, and candidly weigh its advantages and diſadvantages—The firſt advantage England poſſeſſes, conſiſts in her early ſpring; this enables the farmer to commence his work ſooner than he can in this country: to this cauſe it is owing that ſuch crops as require early ſowing on a well prepared fallow, ſucceed better in Britain than here. Barley, for inſtance, requires at leaſt four good ſpring ploughings, and yet ſhould be put in by the firſt of May: this cannot be done here except upon very light lands, our clays being hardly fit to plough before May; but light land will not produce good barley without manure. In England it may be raiſed to advantage on ſtrong loams, and even on clay. It is for this reaſon that barley is nearly as cheap in England as here, though every other grain is ſixty per cent dearer than in America—The ſame reaſoning applies to beans which are unproductive in England, unleſs ſown in February and March, which is hardly poſſible here on ſtrong clays, the ſoil theſe require. Turnips cannot be raiſed in our climate to advantage, as a food for cat-

tle : the ſeaſon in which they are ſown being uſually very dry, and the plants liable to be deſtroyed by the fly. Great Britain has alſo ſome advantage over us in the ſhortneſs of the winter, but much leſs than is generally imagined. Their autumn is cold and wet, and though there is ſome apparent verdure, yet the vegetation is ſo ſlow, as to render it uſual for good farmers to houſe their cattle by the firſt of November, rather than ſuffer them to poach their fields in gleaning a ſcanty ſubſiſtance from them ; nor do they turn them to paſture till late in April.

Theſe are, I believe, all the advantages that the Britiſh farmers fairly claim over us. Let us now examine thoſe we excluſively poſſeſs: The nobleſt of theſe is the *maize* or Indian corn ; neither the beans or turnips of Britain can be compared to this plant : Firſt, it need not be planted till the laſt of May, ſo that the farmer is never hurried by it with his ſpring-work : Second, it is cultivated with a plough or horſe-hoe ; and as the plants are large, and placed at five feet diſtance, there is ample room for this ; and though it is alſo uſual to hand hoe ; yet as this is done after the ground is looſened by the plough, and when the plant is a foot high, and then only juſt about the ſtem, it is eaſier to hoe ten acres of this than one of the turnips or beans : Third, it defies the drought, and never fails to make ample returns to the huſbandman that cultivates it with diligence ; forty buſhels an acre being a common yield when well tended ; and from ſixty to ſeventy, in a good ſoil, and in the beſt ſtate of cultivation. The grain furniſhes a palatable and nutritious food for man, and is greatly ſuperior to any foreign ſpecies for farm ſtock—and while bean-haulm is of little value, the tops and blades of maize are not inferior, if gathered in ſeaſon, to the beſt hay ; and as this crop is eaſily and neceſſarily kept clean, it is the beſt of all fallow crops. The writers on agriculture in England, are conſtantly recommending horſe hoed-crops inſtead of

fallow: but neither precept nor example have been able to overcome the reluctance the great bulk of farmers feel to ſubmit to this expence, for crops ſo little profitable, and requiring ſo much labor if hoed, as either beans or turnips—while maize has, by its ſuperior excellence, and facility with which it is effected, rendered the practice univerſal here, and I believe I ſpeak within bounds when I ſay, that the whole iſland of Britain has fewer acres cultivated with the horſe-hoe, than we have in this ſtate alone.—The want of turnips may be amply compenſated by carrots which may be raiſed at leſs expence here than in Britain, becauſe we have much fewer weeds, which are the greateſt enemies to that root; by cabbages and potatoes, which grow well here; and by pumpkins, which are raiſed in very conſiderable quantities in our Indian corn fields, without any other expence than that of dropping a few ſeeds in the hills, and carting the crop—Nor can I help recommending them as a rich and nutritious food that will ſave two month's hay, if uſed in the beginning of the winter, and afford milk and butter equal in quantity and quality to the product of the richeſt paſture—Theſe legumens would not be ſo much neglected here as they generally are, were it not that hay is made in this country at half the expence that it requires in the moiſt climates of Britain: Vegetation there is extremely ſlow; their ſpring is nearly one month earlier than ours; yet though their wheat begins to grow in March, it is not reaped till late in Auguſt—ours is cut ſix weeks earlier, though it does not begin to vegetate till late in April: So that it takes five and one half months in Britain to perfect a crop which is performed here in little better than three. The ſame cauſes influence the growth of graſs—In ſoils therefore of equal quality, much leſs will grow in a given time in Britain than in America, as I infer from the general average of their clover and natural graſs in not exceeding ours, though they are longer in

a growing ſtate. It is true, that the moiſture of the climate, and mild winters, give a great verdure to their fields at ſome ſeaſons; but this is only an apparent advantage, which deceives ſuperficial obſervers, while it is attended with real inconveniences: Firſt, the graſs itſelf is by that circumſtance rendered leſs nutritious, as is well known by every farmer: Second, while the hay is lighter, it is got in at more expence than ours, which is made at the drieſt ſeaſon of the year—In our crops of grain we enjoy ſimilar advantages; their harveſts are frequently wet, while nine years in ten ours is got in without the leaſt obſtruction from rain—The produce would alſo, I am well ſatisfied, be greater here than in England on highly cultivated ſoils, ſince it is well known that the ſtrength of the ſtraw depends upon the dryneſs of the ſeaſon. In a moiſt climate, therefore, without ſufficient ſun to harden the ſtraw, heavy crops muſt be very often injured by lodging—eſpecially if we take into conſideration, that high winds are much more uſual in Great Britain than here—Blight and mildew are effects of a moiſt climate; theſe are ſeldom and partially known in this ſtate, prevailing only in particular diſtricts in extraordinary ſeaſons. In Britain it often happens, that wet weather, when the wheat is in bloſſom, affects all the wheat in the kingdom, many parts of which, on this account, do not pretend to raiſe it.

If vegetation is ſlower in Britain than here, and if the graſs is alſo leſs nutritious, it muſt follow, that with the ſame attention to ſtock our paſtures with the beſt graſs, and to keep the cattle out of them at improper ſeaſons, a larger ſtock may be maintained on the ſame quantity of ground in this ſtate, than in England; and thus the difference in the length of our winter be amply compenſated. This obſervation leads me to a circumſtance in Britiſh huſbandry, which might be advantageouſly practiſed by us—Many of their farmers ſow rye for the uſe of their

ſheep and lambs in the ſpring; in order to do this they muſt be at the expence of a fallow, and as their rye grows two fifths ſlower than ours, it muſt follow that they can only keep three ſheep, where we may have five. If therefore this practice is advantageous in England, it would be much more ſo in America, to ſow our corn fields with rye, to feed off with ſheep in the ſpring, not only becauſe of the additional numbers that we can keep, but becauſe we are more pinched for ſheep-food in the ſpring; beſides that the rye that coſts the Britiſh farmer a complete fallow, coſts us nothing but the ſeed, if ſown among the corn when it is topped; and as five ſheep will leave more manure than three, the rye field ſo fed down, will be left in better order here by this practice, than it would in Britain.—In the healthfulneſs of our ſtock we have alſo great advantages over Britain. Among our black cattle I have been told that ſome diſorders prevail, though they are ſo extremely rare, that in twenty years ſince I commenced farming, I do not recollect to have loſt one creature, unleſs it were by ſome accidental hurt: nor have I known any others to die among my neighbors, except from the ſame cauſe, or bad keeping in the ſpring: and while the rot ſweeps away whole flocks of ſheep in Britain, it is a diſorder entirely unknown in this country.

All theſe natural advantages being in favor of the American farmer, I ſhall be aſked how it happens that the lands in Britain are more productive: Admitting the fact, which however is not quite out of doubt, when the general average of the cultivated parts of both countries, are compared, the anſwer would be found in the low price of labor, and in the high price of land. More labor is therefore expended upon leſs land there, and the product is always in proportion to the labor, the ſoil and the climate. But does it yield more profit to the cultivator?—No man need to be told that a garden where one

man is conſtantly employed upon half an acre of ground, will produce more pulſe than the ſame quantity of ground cultivated with a plough, in which way one man can tend ten acres; but does it follow the one half acre is more profitable than the ten acres, even though the additional rent ſhould be ſuperadded? That huſbandry is more profitable here than in Britain, is evident from this ſingular circumſtance, that the labor is dearer, and lands proportionably worſe cultivated, yet the American farmer can afford to ſell his product ſixty per cent cheaper than the Britiſh huſbandman—The reaſon is obvious: In England a greater capital is neceſſary, even though labor is cheaper than in America, to render their lands equally productive, and the intereſt of their capital muſt be added to the price of the produce. In Britain the average of labor, when the laborer is lodged and fed, is below forty dollars a year, here it is above ſixty; and yet the American farmers can afford to ſell their product ſixty per cent cheaper than the Britiſh cultivator: Does it not follow then, that the ſame labor produces more by ſixty per cent, and the whole difference of the price of labor? And where the cultivator, as is the caſe with moſt of our farmers, is his own laborer, is not the difference in the price of labor to be conſidered as part of his profit, ſince he earns ſixty dollars where a Britiſh cultivator earns forty; and yet makes ſo much more from his land over and above this difference in the value of his own labor, as to underſell the Britiſh farmer even in his own market?

All theſe obſervations are intended to apply to lands in their common ſtate, not to lands on which a great capital has been expended in one country, and nothing in the other. Thus I do not mean to ſay that a bog meadow in America without a ditch, ſhall produce as much as a meadow reclaimed at a great expence in Britain; or that a piece of clay ground in England completely under-drained, will

not produce more than a ſimilar piece here without a ſingle water-furrow: I know too that theſe improvements are much more uſual in England than in America, where lands are cheap, and the farmers' capitals too ſmall for expenſive improvements: all I mean to ſhew is, that this country has natural advantages in its ſoil and climate over Britain, and to encourage our farmers to hope, that whenever their circumſtances ſhall enable them to circulate their artificial improvements, that agriculture will be carried to a much higher pitch here than in Britain: One of the cheapeſt and moſt obvious improvements, and to which England is more indebted than to any other, is the ſowing of graſs ſeeds, and particularly clover, and putting in their wheat upon a clover clay inſtead of an expenſive fallow. To this permit me to add another from my own experience, which is the practicability of raiſing lucerne as eaſy here as in any part of the world: a plant which as much exceeds red clover, as the red does the common white; but which the want of ſun, and the moiſt climate of England generating an infinity of weeds, prevents their cultivating to any advantage—to theſe phyſical, every man's reflections will add thoſe moral advantages that ariſe from the enjoyment of freedom under the happieſt of conſtitutions; the equality of our fortunes, which facilitates our mutual intereſts; and the reſpect in which agriculture is held by thoſe who govern and direct our affairs; where the hero, the patriot, the ſtateſman, WASHINGTON, does not diſdain to guide, who can refuſe to venerate, the plough?

Experiments and Obſervations on Lucerne.
By the Hon. ROBERT R. LIVINGSTON,
Preſident of the Corporation.

EXPERIMENT—N° I.

APRIL 20, 1791—Mixed 2 lbs. of lucerne with 2 lbs of clover ſeed, ſowed them with oats on 1-4 of an acre of ground, the ſoil ſand to the depth of 14 feet, but in good order, having been the two preceding years in potatoes with dung.—6th April, 1792—Spread two buſhels of gypſum.—May 25—The clover very luxuriant; the lucerne, though of ſuperior height, branches ſo little, and is ſo compreſſed by the clover, as hardly to attract attention. About the middle of June, cut the graſs-product in dry hay, a large load for two oxen, or ſomewhat more than half a ton.—Auguſt 8—Cut a ſecond crop about 5 cwt. The ſummer having proved very dry and the ſoil being naturally ſo, the clover did not riſe ſufficiently to be cut, ſo that this crop conſiſted wholly of lucerne: I now experienced the want of ſeed, for though the lucerne was about 27 inches high, it occupied too little ſpace to produce a great crop. The lucerne and clover roſe after this cutting, and might have yielded a tolerable crop, but I preferred leaving the rowan to protect the roots againſt the winter winds.—1793, 1ſt April—Dreſſed this ſpot with one buſhel of gypſum.—28th April—The ſpring proving uncommonly early, the ground being naturally warm, having a ſouth aſpect, and the plants having been protected by a good winter coat. The lucerne exhibited a moſt beautiful appearance; it was 13 inches high, the clover growing with it not more than two. The common paſtures were barely green. As my hay was gone, and none to be purchaſed, (the year

preceding having yielded but bad hay-crops) I was compelled to employ my lucerne to feeding four plough horſes, three times a day in the ſtable as they came from their work; and four ſows that had pigs, which were regularly fed with it three times a day; the horſes were turned out at night to glean what they could in the paſtures; it laſted them till the 23d of May, and what was laſt cut, was near three feet high.—10th June. Began again to cut for two very large coach horſes, kept altogether in the ſtable; it laſted them to the twenty-eighth. In this cutting the clover amounted to near one half of the crop, which was I think more productive on that account than the one that preceded, or thoſe that followed it. On the 28th of July, mowed a third time for hay; the product as nearly as I could judge, about 6 cwt. dry. The clover aided this crop very little, the drought having prevented it from riſing much after the laſt cutting, and indeed a conſiderable part of it had dried out. As no clover appeared after this, and the lucerne was perfectly free from weeds, I conceived the idea of leaving it for ſeed; and did not therefore cut it when in bloſſom, as I might have done, and have had a fifth crop: the ſeeds were not ripe till the 1ſt of October, when it was again cut, and produced about 6 cwt. of dry hay. Though the ſeed looks fair and ripe, and promiſes to yield a conſiderable quantity, yet from not underſtanding the management, or from the lucerne's having been touched by the froſt, I have been able to make no hand of collecting it; perhaps after it has laid longer, it will be more eaſily ſeparated from the pod.

Expence per Acre of this Experiment.—No. I.

	£.		
Ploughing, &c. charged to oats,			
16 lbs. clover and lucerne ſeed, at 1/3	1	0	0
Sowing and harrowing in, . . .	0	3	0
8 buſhels gypſum, at 4/. . . .	1	12	0
1ſt cutting, making, &c. . . .	0	10	0
2d do.	0	8	0
	3	13	0

2d Year, 1793.		£. 3	13 0
1ſt cutting and feeding,	0 10 0		
2d do.	0 10 0		
3d do. and making into hay, &c.	0 8 0		
4th do. do.	0 8 0		
4 buſhels of gypſum, at 4*ſ*	0 16 0		
		2	12 0
Total expence per acre,		£. 6	5 0

Profit per Acre, 1792.

1ſt crop, 2 tons of hay, at 2*ſ*6	5 0 0		
2d crop, 1 ton of hay,	2 10 0		

1793.

1ſt crop, invaluable, as neither hay or oats were to be got, valued at 2 tons hay,	5 0 0		
2d crop, two horſes, or at rate 8 per acre, 18 days, at 6*d.* per diem,	3 12 0		
3d crop of hay, 24 cwt. at 2*ſ*6	3 0 0		
4th do. excluſive of ſeed,	3 0 0		
		22	2 0
Deduct expence,		6	5 0
2 years—Clear profit per acre,		£. 15	17 0

Encouraged by this ſucceſs, I went this year, 1793, largely into the culture of lucerne; as land marks to others, my errors and loſſes are now to be recorded.

20th March, 1793.

EXPERIMENT—No. 2.

LAND a light loam, indifferently prepared for wheat by two ploughings only, being an old paſture in little heart, ploughed every fifth year for fifty years paſt, and never manured; ſown laſt autumn with wheat; ſowed over eight acres of the wheat, lucerne and clover, in various proportions, to the amount of forty pounds of clover, and ſeventy-ſix of lucerne ſeed; manured at the ſame time with fifty-ſeven buſhels of gypſum in various proportions, from five to ten buſhels per acre. The largeſt quantity produced the beſt wheat, and the whole being bet-

ter than could have been expected from the ſoil; the farmers who inſpected the crop were of opinion, that the gypſum had been of uſe to the wheat. The graſs ſeeds vegetated very well, and came up thickly, but not vigorouſly. A drought, very unuſual at that ſeaſon, came on as early as the laſt of April and continued till the middle of June: the clover and lucerne promiſed ſo little when the wheat came off, that I fed the ſtubble (this experiment-ground being part of a large field;) I ſhall order it to be encloſed, to ſee whether the next year will repay a part of my expences, which ſtand as follows:

116 lb. lucerne and clover ſeed, . .	6	9	4
Sowing, ...	0	3	0
57 buſhels of gypſum, at 4*ſ.* . .	11	8	0
Carting and ſowing do. . . .	0	10	0
	£. 18	10	4

EXPERIMENT—No. 3—1793.

LAND a light ſandy loam, three years under clover, and twice in that time manured with gypſum, ſeven buſhels to the acre; broke up 20th April, ſowed with oats on one ploughing, ſod harrowed fine; over three acres of this ſowed on the 1ſt of May, eight pounds of clover, and eight pounds of lucerne ſeed to the acre mixed, at the rate of ſixteen pounds ſeed. The oats came forward with ſuch luxuriance (yielding ſixty-four buſhels on the average to the acre,) and ſuch abundance of ſtraw, that the greater part was lodged, and the graſs ſeeds ſo effectually deſtroyed, that I have ſince ploughed up the ſtubble; this was alſo dreſſed with gypſum, five buſhels to the acre.

Expence.

48 lb. clover and lucerne ſeed, . .	*£.* 2	16	0
Sowing, ...	0	2	0
15 buſhels of gypſum, at 4*ſ.* . .	3	0	0
Sowing do. and harrowing, . .	0	6	0
Entire loſs, except the gypſum may be of uſe in the next crop,	*£.* 6	4	0

EXPERIMENT—No. 4—1793.

SOIL and management as above; being part of the ſame field. Ploughed twice for barley; once laſt autumn; once early in April; ſown with barley about 20th. Sowed the next day two acres of this ground with clover and lucerne, mixed eight pounds of each to the acre, except about half an acre with lucerne alone, ſixteen pounds to the acre, harrowed with a light harrow. The lucerne and clover came up very well, and would have produced about half a ton of hay to the acre, had it been mown this autumn; it has been fed down, though not ſo cloſely as to injure it. Put in at the ſame time, and in the ſame manner, one acre upon a ſtrong loam, laying flat, and ſomewhat wet, the ground having yielded potatoes for the two laſt years. The lucerne after the barley on this ground, is very promiſing, and has not been fed—Expences the ſame as above, £. 6 4 0 on the three acres: however I am well ſatisfied that the enſuing crop will amply repay the expence.

EXPERIMENT—No. 5—1793.

LAND, a hill ſide; ſoil, flaty gravel, on a clay bottom, had been two years under white clover, brought in by gypſum, without being ploughed or ſeeded. Ploughed twice this ſpring and ſummer; one acre ſown with one peck of buck-wheat, 1ſt July, after which ſeeded with 18 lbs. of lucerne, and manured with 7 buſhels of gypſum, a ſhower fell juſt after it was ſown. The lucerne came up ſtrong and healthy, and for ſome days ſeemed to keep pace with the buck-wheat; but this in a ſhort time, owing to the gypſum (as appeared by a ſmall ſpot that I had not given any) ſhot far a-head, roſe to near five feet in height, and ſo effectually overſhadowed the lucerne, that I had no hopes of ſaving it, but by cutting down its too powerful rival; I moved a ſmall part, but ſo much againſt the inclination of my over-

ſeer, who wiſhed to ſee whether it would be as productive in grain as in haulm; in which I own alſo my own curioſity was very much intereſted; I accordingly let four-fifths of the piece take its chance, and the lucerne continued as well as it was able with its umbrageous inmate. Where the buck-wheat had been cut, the lucerne at firſt languiſhed, from being ſo ſuddenly expoſed to a hot ſun; but, as the buck-wheat roſe again, the lucerne ſprung with it, and neither much out-topping the other, the firſt recovered its looks, and promiſes very well. Where the buck-wheat was left to ripen, as the whole lodged, the lucerne, if not abſolutely dead, is at leaſt ſo very ſickly, that I dare not promiſe myſelf much return from this experiment.

Expence of Experiment—No. 5.

18 lbs. ſeed, at 1*d.*	1	1	0
Sowing and harrowing,	0	2	6
6 buſhels gypſum, and ſpreading,	1	7	0
	2	10	6

EXPERIMENT—No. 6.

PLOUGHED one-third of an acre of oats-ſtubble, mentioned in Experiment No. 4; ſowed 1ſt Auguſt with turnip-ſeed and 5 lbs. of lucerne, being all I had left; the turnips too ſmall to gather, the lucerne came up well, conſidering the quantity of ſeed, which was much too ſmall, the only object of this experiment was to ſee whether ſowing upon ſtubble would forward the plant more than a ſpring ſeeding. Next year will anſwer this enquiry.

EXPERIMENT—No. 7—1793.

BROKE up the middle of May a ſmall ſtrip of ground next to the lucerne of Experiment No. 1. Raked fine and put in one pound lucerne-ſeed alone. This came forward ſo faſt as to flower, and many plants, had they not have been cut, would have probably perfected their ſeed.

The general reſult of theſe experiments, in which I have employed 230 lb. of ſeed, and expended £. 30 18 10, cannot be abſolutely pronounced upon till the next year. No. 1, will doubtleſs pay me the enſuing ſeaſon, what it has done this, as it contains no marks of deterioration, to wit: £. 3, after deducting all expences for one quarter of an acre, or £. 12 per acre clear profit. No. 2, may poſſibly pay its expences in good paſture next year, as the lucerne and clover are ſtill alive, though not promiſing. No. 3, is totally loſt. No. 4, looks ſo well, that I can hardly doubt that it will yield as much as my firſt experiment did, that is about three tons of hay an acre the firſt year, and proportionably afterwards; nor am I quite out of hopes of No. 5. It might perhaps have been thought better to have deferred this communication till another year had afforded me the means of ſtating theſe reſults; but as I was led into this courſe of experiments with a view to acquire ſuch a knowledge of this plant, and the mode of cultivating it, as would enable others to avail themſelves of my errors and my experience, without incurring expences that would diſcourage them in the outſet, I have thought it prudent thus early, to ſtate them, ſince even now important deductions may be drawn from them.

From the firſt experiment it appears, that it may be eaſily ſown on a dry ſoil with oats and clover, and that its annual clear profits after deducting every expence, will exceed, on the two firſt years, £. 7 per acre. The failure therefore of that ſown this year with oats, muſt be aſcribed to the following cauſes: 1ſt, A luxuriance in the oats, which was by no means to be expected from the ſoil, and is wholly to be attributed to the improvement it had received from clover and gypſum, and is ſo far a ſtriking leſſon to farmers, as well as a confirmation of the conjectures I had the honor to ſubmit to the ſociety on the effect of gypſum as a permanent improver of the ſoil. 2d,

The oats having been ſown on one ploughing, ſo that the ground was leſs mellow than it ſhould be for the reception of lucerne.—3d, To the extreme drought of the ſpring; clover having not ſucceeded better than lucerne, when ſown together. The ſecond experiment proves that ground which has not been ploughed in the ſpring, or pulverized fully, is improper. The failure, however, of this experiment, may in ſome ſort, be charged to the early ſowing, ſince the rapid growth, of that ſown with the buck-wheat, during the hotteſt ſeaſon of the year, would intimate that the ground ſhould be warm and mellow, to ſuit the conſtitution of this plant while in its infant ſtate. The ſucceſs that attended the ſowing with barley proves, that notwithſtanding the unfavorable ſeaſon, if the earth is properly pulverized, a good product may be expected.

An important queſtion ſtill remains to be decided, relative to the propriety of ſowing lucerne alone or mixed with red clover ſeed. I was prejudiced in favor of the latter mode from the following conſiderations:

1ſt. I wiſhed to know whether it was equally hardy with clover? Whether under ſimilar circumſtances it was able to contend with it in our climate? Experience has convinced me that it will, and that in dry ſeaſons it will flouriſh—while clover is too faint and languid to raiſe its drooping head; and what is more extraordinary, that this child of the ſummer, better braves the biting froſts of the ſpring and the keen autumnal blaſts, than clover, or any cultivated graſs of this climate.—Theſe are important circumſtances, when I am laboring to introduce it into common huſbandry, in the face of prejudices ariſing from the Engliſh experiments, which are far from encouraging to farmers of moderate capitals; I hope, however, to ſhew, that it is infinitely better adapted to our climate than to that of Great Britain.

2dly. It having been conſtantly aſſerted that it takes three years to come to perfection, and that the proſpects are very trifling the year ſucceeding that in which it was ſown, by mixing the ſeeds with thoſe of clover, I expected, and indeed found, that an immediate profit might be obtained; for the clover came forward as early, as if it had been ſown alone, was ſupported by the lucerne, which added ſomething to the crop, and both together yielded at the rate of more than three and a half tons an acre, the very firſt year; the merit of the laſt cutting being wholly due to the lucerne, ſince the drought prevented the clover from riſing a ſecond time to the ſcythe; ſo that, had this field been ſown with clover alone, it would have yielded twenty-four hundred weight per acre, and leſs than it did by the addition of the lucerne ſeed the *very firſt* year.—The ſecond year's product is ſtill more concluſive in favor of the lucerne.

3dly. As clover is a beneficial plant, I expected that as the lucerne advanced, the clover would die out and leave the ground free from weeds that might have robbed the heritage during the minority of the lucerne. Though this reaſoning was plauſible and influenced my conduct in my experiments this year, yet I am not ſatisfied that it is juſt. I argued from Engliſh books of huſbandry, which are not however, calculated *in this particular* for our climate. The principles they maintain are—1ſt. That lucerne does not attain any conſiderable degree of ſtrength till the third year; hence the neceſſity with them of drilling and hoeing to keep down the weeds. Some that I ſowed this year with my barley, as well as a crop which my neighbor Mr. De La Bigarre ſowed with his, yielded, on being cut this very autumn after his barley, almoſt eleven hundred weight per acre, convinces me that its growth is more rapid here than in England—(In this however it is not peculiar, as I ſhall on ſome other occaſion ſhew

that plants grow more rapidly by two-fifths here than in Britain) I am therefore very doubtful whether it will not pay as much and as early, provided from ſixteen to twenty-four pounds of ſeed are ſown to the acre, as the mixed crop would do. This I ſhall next year aſcertain with accuracy.—Should it be eſtabliſhed on experiment, the clover-ſeed ſhould be omitted, as it tends to check the lucerne, and to render the crop thin when it dies out; beſides, that neither ſpringing ſo early, nor bearing drought ſo well, it muſt be conſidered as inferior, in every reſpect, to the lucerne. There is one conſideration however in its favor, that is, that in warm ſituations, the lucerne will be fit to cut before the clover riſes to the ſcythe. The ſecond crop in this caſe, will be earlier, on account of the clover, which will conſiſt almoſt wholly of it, becauſe having eſcaped the wounds which the lucerne received, it will be ready to take the field before the lucerne has recovered from its amputation.

There are two conſiderations which render weeds here leſs troubleſome than in Britain; the *ſeverity of our winter*, and the *heat of our ſummer*. Many, from the firſt of theſe cauſes, are annual here, which are perennial there, by being able to live through their mild winter. The ſlighteſt fallowing in the heat of ſummer, kills moſt weeds here, while in England their moiſt climate enables the greateſt part of them, like Anteus, to bid defiance to wounds and bruiſes, if they are permitted but to touch their parent earth. We may add to this that the indigenous weeds of this country are few, becauſe the children of the foreſt, as well of vegetable as of animal tribes, fly the haunts of men; the only troubleſome weeds we have are convicts, that have been tranſported from our mother country—They muſt therefore, neceſſarily, be much fewer than thoſe that remain behind, not only becauſe the habits of many of them are too delicate to aſſimilate themſelves to our unpoliſhed cli-

mate, but becauſe their number, in both countries, muſt be proportioned to the time from which they began to be cultivated, and to the extent of their commerce—for *weeds* and *vices* are the children of *cultivation* and *commerce*. Nor will they ever be eradicated in an improved country till ſome agricultural millenium ſhall advance cultivation to the higheſt poſſible point of perfection: All theſe conſiderations form decided arguments in favor of the cultivation of lucerne (whoſe greateſt enemy is ſaid to be weeds) in this country, rather than in England. Upon the whole then I would recommend, as the reſult of my experiments, as far as they have yet gone:

1ſt. Never to ſow on ground that is not perfectly pulverized.

2d. Not to ſow till the earth has acquired a degree of warmth friendly to rapid vegetation, that is, not earlier than the month of May.

3d. To ſow with no crop that will probably lodge.

4th. If ſown with buck-wheat, to apply no gypſum or other manure, till the buck-wheat is off.

5th. Where the quantity to be ſown is ſmall and the farmer can afford to loſe a crop, to give the ground one turn in the autumn, another in April, harrowing it fine, and a third the beginning of May, and then if the weather is mild and warm, ſow, if the ground is in perfect tilth, otherwiſe give it another ploughing: eighteen or twenty pounds of ſeed are not too much; were it not for the expence I ſhould prefer twenty-five pounds if an early crop is the object.

I fear that I have, in the opinion of many, dwelt too long on this ſubject; if I have, my apology will be found in my anxiety to impreſs upon my countrymen, the importance of cultivating this plant, which I am ſatisfied, is better adapted to our climate than clover; which exacts no more labor; which leaves (I ſpeak upon the authority of Young's travels) the ſoil much better than it found it; which will even bear paſturing; having myſelf re-

marked two plants in a common paſture which had defied the bite of cattle for upwards of twenty years, one of which is ſtill alive.

Theſe conſiderations have induced a conviction in my mind, that the man who introduces a plant which promiſes to be ſo important to agriculture, will have a better claim to the gratitude of his country than any other, that one only excepted, whoſe civil and military virtues have afforded us the means of purſuing in peace, our ruſtic labors. I confeſs that I am not unambitious of that honor—to the rich I have facilitated the means of procuring the ſeed, which has hitherto been very rare here; ſmall parcels I have diſtributed to common farmers, whoſe exertions I have ſtimulated, by ſhewing the flouriſhing ſtate of my little field; nor can I conclude without addreſſing myſelf (in the words of the goſpel) to every member of the corporation, who is bleſt with equal or greater means, "*go thou and do likewiſe.*"

Experiments on Lucerne.

By the Hon. ROBERT R. LIVINGSTON.

(Continued—from laſt year.

THE delay which has attended the printing of our memoirs, enables me to lay before the ſociety, a continuation of the experiments upon lucerne, which I had laſt year the honor to ſubmit to their conſideration.

No. 1—*Continued.*

1ſt April—Manured with ten loads of black earth from a ſwamp—or at the rate of forty loads to the acre.

It was very luxuriant and cut twice before the twentieth of June for plough horſes kept in the ſtable—being when they began to cut each time, about ſixteen inches high, the average height, taking the

firſt and laſt cutting, each time about twenty inches. On the 24th July, cut and made into hay, produced one thouſand weight or two tons to the acre. On the laſt of Auguſt, cut a fourth time—produce, ſix hundred weight, or one ton four hundred weight to the acre. The fifth crop is not cut, but is now the firſt of October, twenty inches high, and very promiſing in its appearance; if we have no ſevere froſt before the middle of this month, it will produce about ſix hundred weight of hay.

Produce and Expence per Acre of No. 1.

Expence.

	£.	s.	d.
40 loads of black earth from an adjoining ſwamp—at 1*s.* per load	2	0	0
Cutting 5 crops and making three into hay—at 8*s.*	2	0	0
	£. 4	0	0

	Tons.	C.
Two firſt crops valued at 500 wt. hay each, or	2	0
3 crops in hay	2	0
4th crop in do.	1	4
5th eſtimated at	1	0
	6	4

	£.	s.	d.
6 tons 4 cwt. at 2*s*6	15	10	0
Expences above	4	0	0
Profit	£. 11	10	0

There are ſo many vacant ſpots in this piece, owing to its being too thinly ſeeded, that I am ſatisfied that had I ſown the lucerne alone, at the rate of twenty pounds, inſtead of eight pounds to the acre, that produce would have been at leaſt one third more, though I believe eleven pounds ten ſhillings per acre, after paying for manuring and all expences, will be deemed ſufficient profit to juſtify the culture of this in preference to any other graſs.

No. 2—*Continued.*

The lucerne ſown over the wheat in the ſpring of

1793, yielded nothing, ſo that the whole of this muſt be ſtated as loſs, except that the expence of gypſum ſhould be deducted from the account, as it produced a very noble crop of white clover, on ground on which I ſhould otherwiſe have had little paſture.

It is however to be remarked, that the red clover ſeed ſown over the wheat at the ſame time, in the manner mentioned in the experiment, ſucceeded no better than the lucerne; this muſt be attributed in part to the ſeaſon—and the experiment of lucerne upon wheat ſhould again be tried, but only on a ſmall ſcale, as I am inclined upon the whole to think it will ſeldom ſucceed.

The lucerne ſown with the oats, as I mentioned, was ſo choaked by it as to promiſe nothing; that ſown with buck-wheat very little for the ſame reaſon, and both were ploughed up. The remaining experiments are thoſe in which the lucerne was put in with barley and with turnips. The firſt of theſe I muſt divide into two claſſes—1ſt. That ſown on light loam—2d. That ſown on clay.

Product and Expence, per Acre, of two Acres of Lucerne, ſown with Barley and Clover, April, 1793.

	T.	C.	Q.
26th June, cut and made into hay	1	2	0
26th July	1	5	0
20th September	1	4	0
	3	11	0
Expence per acre cutting and making hay 8*s* per acre	£. 1	4	0
3 tons 11 cwt. of hay, at 2*s*6	£. 8	17	6
Deduct expences	1	4	0
Clear profit	£. 7	13	6

Part of this was injured by the poultry and pigs which were conſtantly upon it—thoſe parts on which

clover was mixed with the lucerne, very much inferior to that on which the lucerne grew alone.

Lucerne and Clover on Clay.

This cut only twice—the ſecond time the 20th of Auguſt : The product at both cuttings three tons to the acre—the firſt crop was much injured by the cattle breaking in, and by its being lodged. The lucerne among the clover is now fit to cut a third time, but having been ſown thin, it will not make a crop alone, and the clover is too ſhort to be worth cutting ; but the after graſs is ſo fine, as to be adequate to all the expences attending the two firſt crops, ſo that three tons of hay or ſeven pounds ten ſhillings may be conſidered as the neat profit upon this acre.

Lucerne ſown with Turnips, Aug. 1793.

I expreſſed my fears that this lucerne would hardly live through this winter—however I was agreeably diſappointed ; early in the ſpring, though the plants were ſmall, and as I thought much too far apart, yet as the ſeaſon advanced, they ſhot forward very luxuriantly, and this piece has been cut three times with that ſown with barley. Although ſown near four months later, the firſt crop was nearly equal to the barley ſown, the ſecond and third much ſuperior to it, ſo that its acreable produce may be ſtated at four tons ; and its future product will be greater than any I have, as it is perfectly even, without any vacant ſpots, and uninjured by the clover which I ſowed with my other crops.

The introduction of a new plant is liable to ſo many difficulties from ill management and prejudice, that I think it important ſtill to continue the regiſter of my experiments at the riſk even of tiring the patience of the ſociety.

I remember the avidity with which I read every thing that I could find on this ſubject, before I began

my own experiments, and I remember too how much all I read fell ſhort of my wiſhes in many particulars, which I am now able to elucidate for the benefit of others.

EXPERIMENT—No. 1.

Sept. 1793. Ploughed up four acres oats-ſtubble, ſoil, a light loam—1791-1792, in clover, manured with gypſum; 1793, in oats, yield very great—about ſixty-four buſhels to the acre.

April, 1794. Ploughed twice—1ſt May ſowed two acres with barley and thirty-ſix pounds of lucerne ſeed, which covered by the roller.

This barley was but tolerable, yielding about twenty buſhels to the acre. The lucerne is far from anſwering my expectation; it is thin and in patches; the rains which prevail this ſummer have filled the ground with clover, ſo that I expect next year to cut more clover than lucerne from this ground.

EXPERIMENT—No. 2.

The adjoining acre was ſown with lucerne alone without barley. It looks at preſent exactly as that ſown with the barley, neither promiſing much as *a lucerne crop*. I ſhould obſerve that theſe plants came up very thick and well, but ſoon changed their colour in ſpots to yellow, and died away, except where the ground was rich.

EXPERIMENT—No 3.

Ploughed up three-fourths of an acre that had been in potatoes laſt year, ſoil as above: dung was put in the rows when the potatoes were planted at the rate of forty loads to an acre.

1ſt May, ſowed with barley and twelve pounds of lucerne-ſeed; the barley good, but much injured by the poultry, being near my houſe. The lucerne a very fine and promiſing crop, cut the laſt of Septem-

ber, about half a ton to the acre. This experiment is important, since it proves that if lucerne is sown in the spring, it should be on ground in good health, and warmed with dung. I have no doubt of cutting four or five tons of hay next year from this spot.

EXPERIMENT—No. 4—one acre, 1794.

Soil as above, but poorer—sown this spring with vetches, they were cut 20th July, for hay—ploughed immediately after, and put in eighteen pounds lucerne seed; it came up very thick, and maintains a healthy colour, though the ground is very full of weeds; this gives me no uneasiness as they are annuals, and the season too far advanced to permit them to ripen their seeds; they will only serve to protect the lucerne against the cold of the ensuing winter.

EXPERIMENT—No. 5.

Half an acre of my last year lucerne standing very thin, I ploughed it up this year, and first July, sowed it with eight pounds of lucerne-seed and a small quantity of turnip-seed having previously manured the ground with stable-dung—this, with a very wet season, has brought up so many weeds as to injure the lucerne by overshadowing it, though it came up very vigorously—on the 20th August, mowed the weeds and turnip tops, which were very large, not however mowing very close. The lucerne at this time, 1st October, though very full of weeds, has a fine healthy appearance, and I have no doubt of its doing very well; the turnips do not appear to have been injured by the mowing.

EXPERIMENT—No. 6.

Soil as above—1st May, planted three-fourths of an acre, with early potatoes, the beginning of the first August took them up and put in upon one ploughing twelve pounds of lucerne-seed—this has

come up even and thick, and is very free from weeds; if it ſtands the winter, which I hardly doubt, it will make a very fine crop the next year.

EXPERIMENT—No. 7.

One acre of gravelly clay ſown this ſpring with vetches left for ſeed, cut about the laſt of Auguſt and the beginning of September, ſowed with ſixteen pounds lucerne: It is now (1ſt October) but juſt beginning to ſhew itſelf, owing to there having ſcarce any rain fallen ſince; and the reſult of this experiment will determine whether it may ſafely be ſown with wheat in good ſoils, and how far it is capable bearing cold when very young.

Having with a view to introduce this very uſeful plant, made (as I believe) more experiments, and upon a larger ſcale, than any other farmer in America, I ſhall ſtate the concluſions which I have drawn from them, as inſtructions to others that may chuſe to cultivate it.

1ſt. It appears to me to be full as hardy as clover; but like it, to delight in a warm dry ſoil, though it will flouriſh in a moiſt clay—ſubject, however, to the ſame caſualties in open winters, when both will be thrown out by the froſt.

2d. When very young it requires a natural or artificial warmth in the ſoil, otherwiſe it languiſhes, and when the weeds and natural graſſes come up, it is unable to contend with them.

Theſe two obſervations point, firſt to the ſoil in which it ſhould be ſown; to wit, a warm dry ſoil in tolerable heart; and ſecond, to the means of procuring the warmth which I ſpeak of as neceſſary to the plant; this may be obtained in two ways: 1ſt, by dung; and 2d, by ſowing when the ſun has given the earth an additional heat. If ſpring ſowing is intended, I ſhould prefer ground that had been manured and bore a potatoe crop the year preceding, becauſe by that means the weeds which the dung produces

will have been deſtroyed by the hoeing the potatoes. If no ſuch ground is ready, and a ſpring ſowing is intended, the dung ſhould be ploughed in July or Auguſt, and the ground harrowed fine; this will bring the weeds forward, when a ſecond ploughing, and the winter will deſtroy them before they have perfected their ſeeds; the lucerne may be ſown early in May (twenty pounds to the acre) after the ground has had three or four ſpring ploughings with barley, which will pay the expence of the manure and ploughings.

Second mode by which the ſeeds will come up quicker, and with more regularity, is to manure early in the ſpring, and to plough and harrow the ground fine when the weeds have ſprung and got ſome head; and when the earlieſt kinds begin to bloſſom, plough again and harrow fine; repeat this four times by the 1ſt of July, when the lucerne ſeed ſhould be ſown (ſixteen pounds to the acre) every ſeed of which will then vegetate: The ſeed ſhould always be ſown when the ground is dry, and rolled in, if committed to the earth while it is very moiſt, the ſeeds will ſwell, and if a dry ſeaſon ſucceeds before they have ſtuck root, they will wither away.

3d—Lucerne is frequently liable to turn yellow, and look ſickly. I have not been able to diſcover the cauſe of this evil, though I have carefully examined the roots with a microſcope—The remedy is to mow the plant; it will come up free from the diſorder.

4th—The time for cutting this for cattle is when ever it will fill the ſcythe; for hay when it begins to bloſſom, if left till the bloſſom turns, it becomes too hard: I would prefer cutting for cattle the firſt year, as this effectually deſtroys all weeds.

5th—It may be fed down by any kind of cattle with as much ſafety as clover.

6th—I would recommend it to the young farmer not to be diſcouraged from purſuing the culture of

this plant by the obſervations of ſome of the older ones, who will tell him that Mr. A, and Mr. B, tried it, *but it would not do.* Experiments careleſsly made or not regularly purſued, the accidental circumſtances of ſoils, or ſeaſons, afford no concluſive arguments, as may be inferred from the regiſter which I have exhibited. Out of about fifteen acres which I ſowed laſt year, but four ſucceeded; had I not tried the plant in various ways, I ſhould probably have determined that it was not worth attention. My errors and inſtructions will render the taſk eaſier for thoſe that chuſe to attempt future experiments. And whether they ſucceed or not, they will render agriculture ſome benefit by communicating to this ſociety the reſult of their experiments.

R. R. LIVINGSTON.

Clermont, 4th October, 1794.

Extract of a Letter from ROBERT R. LIVINGSTON, *Eſq. to* WILLIAM LIVINGSTON, *Eſq. Governor of* New-Jerſey, 1785, *on the Subject of* Green-gage Plumbs.

MRS. LIVINGSTON informed me when I was laſt at Elizabethtown, that you had not been ſucceſsful in raiſing the green-gage plumb. I ſend you two of a very fine kind; I have now above twenty bearing trees, none of which have been grafted, but were all the offspring of one that was raiſed from the ſtone of a grafted tree, which has produced ſome hundred trees, as thoſe I ſend you will do, if planted in a looſe ſoil. The general complaint is, that this fruit drops before it ripens: I do not find that this is the caſe with mine, except ſo far as is neceſſary to keep the tree from being overloaded.—I cannot help thinking therefore, that theſe trees have in many places ſuffered (in common with

an higher order of beings) from the ignorance of their phyſicians, who inſiſt that this evil ariſes from too great a quantity of ſap, or in other words, from too much health, and accordingly direct a ſpare regimen, and plant them in ſtiff ſoils, where they cannot feed without difficulty; and leſt they ſhould not ſuffer enough from this treatment, they cut their roots, put ſtones in their mouths, bind their bodies with bandages, and even go ſo far as to pierce and beat them, as if the fruit of this tree, like that of religion, was the offspring of mortification. I have never yet heard, that theſe preſcriptions have been attended with much ſucceſs; nor do I think they ever will.—Except man, I know no animal that ſuffers from a plethora, nor would he, if luxury had not provoked his appetite to exceed its natural bounds; all others acquire ſtrength from plenty of food; the ſame reaſoning applies to vegetables, whoſe ſeeds and fruits are always moſt perfect, when a ſufficiency of food is furniſhed them. The plumb is in no ſoil a very vigorous tree; its growth is ſlow; and when it begins to bear, it is generally very heavily laden; as the fruit increaſes in ſize, it makes a demand upon the roots for more ſap than they can readily furniſh, particularly as the droughts often come on juſt as this demand is made. The circulation in the tree becomes more languid, and the fruit alters, withers and drops for want of nouriſhment, or is deſtroyed by worms, which are produced in it, as in the ſtomachs of feeble children, from unwholſome food.

If this reaſoning is juſt, the remedy muſt be the reverſe of that, which is uſually preſcribed. I have therefore always planted my plumbs in the richeſt ſpots of my garden (the ſoil of which is a loam upon a light ſand, dug up and mixed, and very highly manured every year) and my trees have ſcarcely ever failed to ripen as much fruit as the branches could carry without danger of breaking. I have alſo had ſome plumbs upon a ſtiff clay, none

of which have borne any fruit worth ſpeaking of; one, a Drap D'or, had ſtood fifteen years, and was not nine feet high when I removed it into my garden laſt ſpring a year; it has grown more ſince, than in the fifteen years preceding. Theſe circumſtances convince me that my theory is right, and has induced me to enlarge upon it, in hopes that it may be uſeful to you, and that when confirmed by your experiments, it may be adopted by others.

Experiments made by Manuring Land with Sea-Weed, taken directly from Creeks, and with Shells:

By EZRA L'HOMMEDIEU, *Eſq.*

THE year before laſt I fenced about ten acres of poor land of a light dry ſoil, and which produced little except *five-fingers* and *ground pine*; it was ploughed up and planted with corn, which was dunged in the holes, but the land was ſo poor that the crop did not pay the expence of culture. Laſt year I contracted for one hundred tons of ſea-weed, at fourteen pence per ton, and let out five acres of this piece of ground for raiſing wheat. I was to find the manure, twenty ox-cart loads to the acre, which was to be carted, and all other expences borne in raiſing the crop, and I was to have the one half of the wheat delivered in the ſheaf in the field: Early in March the five acres was ſowed with clover ſeed; at harveſt the wheat much exceeded my expectation; that which was beſt put in, by computing the ſhocks, would yield ſixteen buſhels per acre—the clover came up very well, and after harveſt headed, and the heads being collected by women and children among the ſtubble, the beſt of it yielded a buſhel per acre, on an average ſay forty pounds (the one half of which I gave for gathering)—there would have been much

more had it not been for the difficulty of collecting among ſtubble, which muſt principally be done by hand; there is no doubt but this five acres will yield at leaſt one ton of hay to the acre the next ſeaſon. The computation of profits on this five acres is as follows:

The one half of the crop, on an average, ſay			
7 buſhels wheat per acre, at 8s. .	£.	2	16 0
20 pounds clover-ſeed, . . .		1	0 0
	£.	3	16 0
Deduct 20 tons of manure, at 1s. 2d. .		1	3 4
The neat profit per acre is .	£.	2	12 8

The land was not worth more than forty ſhillings per acre; but by this tillage, the land, by the loweſt computation, muſt now be worth five pounds per acre, which makes the difference of three pounds, which being added to the neat profit, makes five pounds twelve ſhillings and eight pence clear gain per acre. Three acres of this piece of land, directly after the wheat was ſown, was covered with drift ſea-weed, which coſt nothing but the carting: Early in the ſpring it was ſowed with clover ſeed, the ſea-weed prevented any injury to the wheat from the winter, the kernel was good, and yielded eight buſhels to the acre: the clover came up well, but did not produce more than half the quantity of ſeed which the land adjoining did, which was manured with ſea-weed from the creek. Perhaps theſe three acres may yield half a ton of hay by the acre, the next ſeaſon. The remaining two acres I manured with ſhells called Indian ſhells; that is, the ſhells of clams, oyſters, wilks and ſcollops, collected by Indians, and by length of time ſettled under the ſurface of the ground, and ſo diſſolved as to be broken in pieces and mixed with the earth; twenty loads to the acre were carted on the two remaining acres of the ten; on one acre twenty tons were carted and

laid in heaps ſix weeks before ſowing: on the other acre the twenty loads were carted and directly ſpread, and harrowed in with the wheat: theſe two acres were ſowed early in the ſpring, with daiſy-ſeed; at harveſt the laſt mentioned acre did not produce a ſufficient quantity of wheat (although the kernel was good) to pay the expence of tillage ſeparate from carting the ſhells. The other acre where the ſhells lay in heaps only ſix weeks, was equal to that covered with drifted ſea-weed. The daiſy-ſeed came up well on both acres, but grew much better on the acre where the ſhells lay in heaps, than on the one where the ſhells were immediately ſpread, and by appearance will produce a good crop of that hay the next ſeaſon: in many parts of the country, eſpecially on the ſea-coaſt, there are vaſt quantities of thoſe Indian ſhells, and by the above experiment, it is neceſſary for a crop of grain, that the ſhells be expoſed to the air ſome time before they are put in the ground: if they are carted in the ſpring, and lay in heaps till ſowing, it may well anſwer the purpoſe, though the longer they lay in heaps perhaps the better for the crop; a few experiments which may be made without any expence, will determine the time neceſſary for their expoſure. By a number of experiments made in Suffolk county, thoſe ſhells are found to be a durable manure, and very favorable to the production of graſs, and the land for a number of years is growing better both for graſs and grain.

On Ditches *and* Hedges.

By Ezra L'Hommedieu, *Eſq. Vice-Preſident of the Corporation.*

THE ſcarcity of timber in many parts of this ſtate for fencing where there are no ſtones for walls, has greatly affected the price of land, and farmers will

ſoon be in a very diſagreeable ſituation unleſs ſome expedient be found for fencing their farms at a cheaper rate, in the old ſettled parts of the country, than is at preſent practiſed. In many parts of the new ſettlements too there is but very little timber ſuitable for fencing, the inconveniences of which will ſoon be felt by the inhabitants. In conſidering this ſubject it will readily occur that ditches and hedges can be the only ſubſtitute where there is no ſtone. It will be worth the attention of this ſociety to get information of the beſt method of making ditches and raiſing hedges, that the ſame may be communicated for the benefit of the public. This ſubject is much talked of by farmers; but ſince the deſtruction of the *prim* and the *Engliſh black thorn*, few attempts have been made to raiſe hedges in any manner whatever. In the town of Eaſt-Hampton, in Suffolk county, by the beſt computation, at leaſt two hundred miles of good prim-hedge died in the courſe of two or three years, which was a greater loſs to the inhabitants than if every houſe in the townſhip had been burnt down at the ſame time; it has not as yet been diſcovered what occaſioned the deſtruction of the prim. The Engliſh black thorn in Southampton was nearly equal to the prim in Eaſt Hampton: This has lately all died there, as it has in every other part of the country where it grew. A certain fly makes a hole through the bark of the thorn, and there depoſits its eggs or maggots; the ſap of the thorn runs out at this hole and hardens on the bark, and becomes a hard bunch round the limb, and prevents all circulation of the ſap or juices in that part, and intirely kills the limb; this being the caſe in the different branches from the ſame ſtock, the whole is ſoon deſtroyed. There are frequently three or four of theſe maggots in one bunch; they grow near half an inch long before they become a fly. They have alſo by the ſame means deſtroyed all the plumb and damſen trees on the Eaſt end of Long-

Iſland; and have lately began on the cherry-trees, eſpecially on the black cherry, which was ſet in ditches and bade fair to make good hedges, and in a ſhort time will probably kill the whole; and it is to be feared that they will increaſe and deſtroy all our cherry-trees, though I have not ſeen any large trees injured by them as yet. Where the prim and thorn hedges were deſtroyed no ſubſtitute has been attempted. Where poſt and rail fence cannot be got the ditches are kept up, and with ſtakes and poles on the top a temporary fence is made. It is difficult to ſay what would be the beſt thing for a hedge that we can depend on: The thorn of this country would make an excellent hedge, far ſuperior to the Engliſh white thorn, but we have not as yet been able to raiſe it from the ſeed or haws.

If we may judge by the great mortality of the prim and Engliſh black thorn, the thorn of this country will not be ſo liable to diſorders as ſhrubs which are imported from Europe. It anſwers but little purpoſe to have ditches unleſs you have hedges to ſupport them. The wild cherry is of quick growth, and bears lopping, but is eaſily deſtroyed by cattle who are fond of the leaves; this is the caſe with the locuſt tree. It is found that where lands have been cleared, and young oaks, walnut, or any other trees that will bear lopping, have been left, they have anſwered well for a hedge by lopping the ſame on a ditch, and is a good fence againſt cattle and ſheep. I would recommend the ſetting out any kind of young trees, that will bear lopping, of two or three feet in length, which will be fit to lop on the ditch two or three years ſooner than if raiſed from the ſeed. I have lately gone into this practice, and make no doubt of its ſucceſs. If the pomace of apples is ſcattered in ditches, the ſeed will come up, and if kept from the cattle a few years, will be ſufficiently grown to expoſe to cattle, who will bite the tops and prevent their growing higher; they will then grow thick and

thorny, and make a very good hedge. Laſt year I ſtrewed all my pomace in ditches for this purpoſe. I have ſeen young apple trees put in a ditch, that is, the bank, between the ſods or turfs, when the ditch or bank was making: they grew well, and being expoſed to cattle, became a good hedge, and well ſupported the bank.

On Improving poor Lands, by ſowing Red Clover Seed.

By EZRA L'HOMMEDIEU, *Eſq.*
Vice-Preſident of the Corporation.

SOME years ago, I ſaw a piece of very poor loamy land, grown over with moſs, and yielding no paſture except *five-fingers* and a few daiſies; it was ploughed up early in the ſpring and ſowed with nothing but red clover ſeed, four quarts to the acre. The next year it produced a conſiderable quantity of hay, which was the only crop, though the land was much better afterwards. I make no doubt but this mode of culture might be improved to great advantage. It is the only inſtance I have ſeen of clover ſeed being ſown alone on any land. It is commonly ſaid that the ſowing of this ſeed will anſwer no purpoſe on very poor land; perhaps the reaſon is that wheat, rye, oats, or ſomething elſe, is ſown at the ſame time, which exhauſts all the ſtrength of the land to bring it to perfection, and leaves the clover that comes up in ſo weak and languid a ſtate, that it eventually comes to nothing; when if the clover had all the nouriſhment the land was capable of affording, it might produce a ſufficiency of ſeed the firſt year to pay for the ſeed ſown and the tillage; and the next year a conſiderable crop of hay, which would be a clear profit; and if the lands were ploughed up the next ſpring after cutting the hay, while the roots of the graſs were alive, it would ſo enrich the land that in the next proceſs the ſeed and

hay would be much increaſed, and by continuing this mode of culture the lands would be made good without further manure. I would propoſe that the advantages of this mode of improving poor lands be aſcertained by experiments to be made on different ſoils by gentlemen of the ſociety who are farmers.

On the Folding of Sheep.

By EZRA L'HOMMEDIEU, *Eſquire.*

ON obſerving that ſheep kept by ſhepherds in flocks, and folded every night, for the purpoſe of manuring land, were poor and ſmall, compared to others which were kept in no better paſtures, and not folded, I determined to make an experiment of the profits which might ariſe to the farmer by folding his flocks of ſheep, which I concluded might be advantageous, if properly conducted; for this purpoſe, on the 1ſt day of June, the year before laſt, I fenced and ploughed up one acre in a field which contained about ſeventy acres, and on which were kept eighty grown ſheep, and ſixty lambs. I concluded that if the ſheep were folded every night at ſun-down, and let out every morning by ſun-riſe, the ſheep would not be much injured, the crop of wheat propoſed to be raiſed on the acre would be conſiderable, and the land much improved, which then was very poor.

The ſheep were properly attended to, which was eaſy to be done, as the fold was in the ſheep-paſture, and the farm-houſe not more than twenty rods from the fold. I ſoon diſcovered, after folding the ſheep, which began about the middle of June, that they did not look ſo well as uſual, and was adviſed by the overſeer to diſcontinue the practice: I determined however to make the experiment, and continued the folding till the 1ſt of Auguſt. After which the ground was ſowed with wheat, ſome turnip-ſeed and

red clover ſeed. The lambs were ſo much injured by the practice, that they fold for one ſhilling leſs on an average than thoſe which were raiſed on the ſame paſture before and ſince; and the grown ſheep ſuffered ſo much, that by the beſt judgment I could make, by conſidering their being poorer than otherwiſe they would have been, and calculating the reduced quantity of wool which they yielded the next ſpring, that the average loſs was two ſhillings on each grown ſheep. The wheat was hurt by the winter, though had it not been for this circumſtance, by computing that part which was not winter-killed, the product would have been fifteen buſhels. Sixty buſhels of turnips were pulled from the ſame ground, and I expected that the land would have been ſo improved as to produce a good crop of hay the next year, but in this I was diſappointed; the wheat and the turnips having exhauſted almoſt the whole of the manure which was obtained by the ſheep, and the land left in a ſtate not much ſuperior to what it was at firſt.

Computation of Profit and Loſs.

	£.		
Ploughing, ſowing, and reaping the acre,	1	10	0
Pulling and cutting the turnips,	0	10	0
Loſs on eighty grown ſheep, at 2s.	8	0	0
Loſs on ſixty lambs, at 1s.	3	0	0
Attending the ſheep,	0	8	0
£.	13	8	0

Produce.

Fifteen buſhels of wheat, in caſe no part had been winter-killed, at 8s.	6	0	0			
Sixty buſhels of turnips, at 1s. 6d.	4	10	0			
				10	10	0
Loſs,				£ 2	18	0

By this experiment I was convinced no advantage would ariſe from the conſtant folding of ſheep. The

injury done to the ſheep by folding, appears to ariſe from a number of cauſes. They became very dirty by lying on ploughed ground, which muſt check their uſual perſpiration. Their noſtrils are alſo affected by the duſt, which is taken in with their breath, and their reſpiration impeded, which with the breath of ſo many lying cloſe together, muſt be unfavorable to their health. But the principal cauſe I apprehend, ariſes from their being prevented from feeding at pleaſure, when the dew is on the graſs, when it affords the greateſt nouriſhment. Sheep ſeldom feed in the middle of the day, and drink but very little, which I conclude is owing to their feeding principally while the graſs is moiſtened with the dew. I am induced to believe this, becauſe it is found by experience, that a horſe, by being accuſtomed to go in a paſture without water, will ſoon learn to eat while the dew is on the ground, and will thrive as well as if he could go to water whenever he choſe. It is alſo found by experience, that calves will do better in a paſture without water, than in a paſture of equal goodneſs with water. This experiment, with the reaſons, I purpoſe to communicate to the ſociety at their next meeting.

On Raiſing Calves.

By ERZA L'HOMMEDIEU, *Eſq.*

IN raiſing horned cattle, it is of great importance that the calves be weaned and kept through the ſummer in the beſt manner: If this is not attended to, and they become poor or pot-bellied, it is with difficulty they can be put in a thriving condition, and in general will never recover ſo as to equal thoſe which have not been checked in their early growth. Calves taken from the cows are generally kept in paſtures where there is plenty of water, and a paſ-

ture where there is water, is preferred to one much better where there is no water; but by obſervation, I am convinced that this practice is wrong, and that calves taken from the cows wean much better in a paſture without water, than in a paſture of equal goodneſs with water. Laſt year I ſaw in a paſture without water, more than twenty calves, in which they had been kept without drinking from the time of their being taken from the cows till ſometime in the fall: I frequently ſaw them and obſerved them more attentively, on account of the particular manner in which they were kept; they were all thrifty and remarkably gaunt or ſmall-bellied, which the owner (a gentleman of Suffolk county) imputed to their not having water; and obſerved that he never had calves do ſo well before—and his obſervations on the ſubject very well accounted for the facts. He ſuppoſed that calves accuſtomed to get their ſupport from milk (being a liquid) when they are ſeparated from the cows, and put in a paſture where there is water, after becoming very hungry and dry, betake themſelves to water, which being a liquid, and more ſimilar to what they have been accuſtomed to, than graſs, they drink and drink again, till they appear round and full; but this not being ſufficient to ſupport nature, after falling away conſiderably, they eat a little graſs, and that principally in the day time, which does not alleviate their thirſt ſo as to prevent their drinking too much. But on the other hand, when there is no water in the paſture, the calves, preſſed by hunger, are obliged to feed on graſs which contains ſome moiſture, and ſoon learn to allay their thirſt by eating while the dew is on, and for the ſake of the moiſture or dew on the graſs, eat much more than they would do, if they could go to water, and ſoon get accuſtomed to feed chiefly in the night and in the morning, before the dews are exhaled. By this practice you will ſee no pot-bellied calves, which is occaſioned by drinking

too much, and eating too little: this too brings on poverty in fleſh, which produces lice, and the lice prevent the thriving and growth of the calves till their coat of hair is ſhed the enſuing ſpring. From this and one or two other facts, which I ſhall relate, I am induced to believe that there is ſomething more nouriſhing in dew than is commonly imagined. On obſerving a horſe owned by a perſon in my neighborhood, for a number of years, to be very fat in the ſummer ſeaſon, although it was the only horſe the owner had, and was worked ſteadily, and went in very poor paſture, I aſked the owner by what means he kept his horſe ſo much fatter than his neighbors, who made uſe of much better paſtures. He informed me that he gave the horſe no grain of any kind, but kept him in a very poor paſture adjoining a creek where creek-thatch grew on ſand-flats; that the horſe got but very little from the upland, but fed on the thatch at nights and in the mornings, while the dew remained, but after the dew was exhaled, he would eat no more of the thatch, but return to the upland, and if at liberty would take his reſt the bigger part of the day.

Horſes in general will not eat this thatch, and it is very poor fodder for cattle, although it anſwers with the help of other fodder, to keep them through the winter. The owner further informed me, that before his horſe had learnt to feed on thatch, which was too ſeaſons, he continued to be quite poor in the paſture in which he then went. No perſon acquainted with this ſedge, will ſuppoſe that a horſe can be kept on it in any tolerable order, with common water; and it muſt be ſuppoſed that the dew added very materially to the nouriſhment of the horſe.

It is obſervable, that the dew in ſummer, frequently has a ſweet taſte, not very diſſimilar from honey, and is called a honey-dew. It is probable that all dew has more or leſs of thoſe particles, and affords very conſiderable nouriſhment to animals in general.

Reports of Committees reſpecting the beſt Method of Raiſing Barley and Hops in this State, in conſequence of a Memorial of the Society of Brewers.

On Raiſing Barley.

"IN the fall, or early in the ſpring, as beſt ſuits the economy of the farmer, turn under the ſward, and keep vegetation down with the harrow until the ſeaſon of planting."

"Indian corn prepares the ground well for barley by rendering it mellow, and deſtroying the natural growth of graſs and weeds. After gathering the corn, and removing the ſtalks, manure ſhould be carted on during the winter, or early in the ſpring; ſpread the manure, plough it in, and make the earth as mellow as poſſible: then ſow the barley early, at the rate of at leaſt two buſhels to an acre."

"If the field is to be brought into graſs, ſow graſs-ſeed with the barley, as is cuſtomary with wheat, remembering always, that clover is the moſt ſure."

"Cut the crop when ripe, and not ſooner; the leſs it is expoſed, after cutting, even to the dew, the better, and heavier is the grain. This is the ſyſtem adopted in the ſtate of Rhode-Iſland, where the farmers frequently cut about forty buſhels on an acre."

"On the weſt end of Long-Iſland, the farmers that raiſe barley, plough the ſtubble under as ſoon as the crop is off, check vegetation by repeated ploughing and harrowing, until the time of ſowing wheat, and by this management procure a good crop of wheat, in ſucceſſion to that of barley: But, in this caſe, it is neceſſary to give the ground a larger quantity of manure."

"The committee are at a loſs to ſay, whether barley will anſwer on new ground, as the growth of it has, in their belief, been chiefly confined to old cultivated land. From experience, however, it is known

that the more northern latitudes favor the production of the beſt barley. Whence a preſumption ariſes that the northern and weſtern parts of the ſtate of New-York are well adapted, by nature, for the cultivation of this grain. Therefore, it is highly probable, that the interval lands on both ſides of the Hudſon and Mohawk rivers, as well as on other ſtreams, and between many of the mountains, muſt produce good crops of barley, without the aſſiſtance of manure, every third or fourth year; and upon the plan recommended, both the ſoil and its productions be improved, by the culture of corn, barley, and graſs-ſeeds, with now and then, if neceſſary, a ſeaſonable manuring.

"It is difficult to procure barley free from an admixture of oats: the beſt method of ſeparating the oats from it is by means of water—take a large tub, filled with water, and let the barley run ſlowly into it; the oats and light grains will ſwim on the ſurface, and muſt be ſkimmed off—the heavy and vigorous grains of barley will ſink to the bottom, and ought to be preſerved for ſowing; theſe being the beſt of ſeeds."

"This grain ſeparates very eaſy from the ſtraw; but the beard that adheres to the end of the grain muſt be ſeparated by threſhing it over again after the ſtraw is pitched off. It may be threſhed very well by hand, though horſes, or indeed cattle, will tread off the beard more eaſily than it can be removed by the flail."

"Barley-ſtraw is hearty fodder for horned cattle in the winter."

"By cultivating barley, the farmer will be enabled, with induſtry, to receive his money for a crop in ſix or ſeven months from the time of ſowing; the fall of the year being the time for bringing it to market, and the brewers inſuring him five ſhillings and ſixpence the buſhel, or if he prefers it, the market price."

On the Raiſing of Hops.

The Committee appointed to inveſtigate and report the beſt method of raiſing Hops, offer the following as the moſt perfect the ſhortneſs of the time would allow them to collect—Suggeſting at the ſame time the propriety of a further examination of the ſubject, embracing improvements which time and experience are continually unfolding.

A RICH deep ſoil, rather inclining to moiſture, is, on the whole, the beſt adapted for the cultivation of hops; but it is obſervable, that any ſoil, (ſtiff clay only excepted) will ſuit the growing of hops when properly prepared—and in many parts of Great-Britain they uſe the bog-ground, which is fit for little elſe. The ground on which hops are to be planted, ſhould be made rich with that kind of manure beſt ſuited to the ſoil, and rendered fine and mellow by being plowed deep and harrowed ſeveral times. The hills ſhould be at the diſtance of ſix or eight feet from each other, according to the richneſs of the ground. On ground that is rich, the vines will run the moſt, the hills muſt therefore be the fartheſt apart.

At the firſt opening of the ſpring, when the froſts are over, and vegetation begins, ſets, or ſmall pieces of the roots of hops, muſt be obtained from hops that are eſteemed the beſt*—cut off from the main ſtalk or root, ſix or eight inches in length. Branches, or ſuckers, moſt healthy, and of the laſt year's growth, muſt be ſought for. They may eaſily be known by their looking white. Two or three joints or buds ſhould be left on each ſet. The ſets ſhould be put

* Of the different kinds of hops, the long white is moſt eſteemed. It yields the greateſt quantity, and is moſt beautiful. The beauty of hops conſiſts in their being of a pale bright green colour. Care muſt be taken to obtain all of one ſort—but if different ſorts are uſed, they muſt be kept ſeparate in the field; for there is in different kinds of hops a material difference in their time of ripening; and if intermixed, will occaſion extra trouble in gathering.

into the ground as ſoon as taken up, if poſſible; if not, they ſhould be wrapped in a cloth, kept in a moiſt place excluded from the air. A hole ſhould then be made large and deep, and filled with rich mellow earth. The ſprouts ſhould be ſet in this earth with the bud upwards, and the ground preſſed cloſe around them. If the buds have begun to open, the uppermoſt muſt be left juſt out of the ground; otherwiſe, cover it with the earth an inch. Two or three ſets to a pole will be ſufficient, and three poles to a hill will be found moſt productive. Place one of the poles towards the north, the other two at equal diſtances about two feet apart. The ſets are to be placed in the ſame manner as the poles, that they may the eaſier climb. The length of the poles may be from fourteen to eighteen feet, according as the ſoil is for richneſs. The poles ſhould be placed inclining towards each other as to meet at the top, where they may be tied. This is contrary to the European method, but will be found beſt in America. In this way they will ſtrengthen and ſupport each other, and form ſo great a defence againſt the violent guſts of wind, to which our climate is frequently ſubjected in the months of July and Auguſt, as to prevent their being blown down. They will likewiſe form a three-ſided pyramid, which will have the greateſt poſſible advantage from the ſun. It is ſuggeſted by experience, that hops which grow near the ground are the beſt. Too long poles are not good, and care muſt be taken that the vines do not run beyond the poles: twiſting off their tops will prevent it. The beſt kinds of wood for poles are the alder, aſh, birch, elm, cheſnut and cedar. Their durableneſs is directly the reverſe of the order in which they ſtand, and burning the end put into the ground, will be of ſervice to preſerve them. Hops ſhould not be poled till the ſpring of the ſecond year, and then not till they have been dreſſed. All that is neceſſary for the firſt year, is to keep

the hops free from weeds, and the ground light and mellow, by hoeing often, and plowing if the yard is large enough to require it. The vines when run to the length of four or five feet, ſhould be twiſted together to prevent their bearing the firſt year, for that would injure them. In the months of March or April of the ſecond year, the hills muſt be opened, and all the ſprouts, or ſuckers, cut off within an inch of the old root, but that muſt be left entire with the roots that run down ;* then cover the hills with fine earth and manure. The hops muſt be kept free from weeds, and the ground mellow, by hoeing often through the ſeaſon, and hills of earth gradually raiſed around the vines during the ſummer. The vines muſt be aſſiſted in running on the poles with woolen yarn, ſuffering them to run with the ſun.

By the laſt of Auguſt or firſt of September, the hops will ripen and be fit to gather. This may eaſily be known by their colour changing, and having a fragrant ſmell: their ſeed grows brown and hard.† As ſoon as ripe, they muſt be gathered without delay, for a ſtorm, or froſts, will injure them materially. The moſt expedient method of picking hops, is to cut the vines three feet from the ground, pull up the poles and lay them on crotches horizontally, at a height that may be conveniently reached. Put under them a bin of equal length, and four may ſtand on each ſide to pick at a time. Fair weather muſt be taken to gather hops in, if poſſible; and hops ought not to be gathered when the dew is on

* Hops muſt be dreſſed every year as ſoon as the froſt will permit. On this being well done, depends in a great meaſure the ſucceſs of the crop It is thought by many to be the beſt method to manure the hop yard in the fall. and cover the hills entirely with manure ; aſſerting, with other advantages, that this prevents the froſts during the winter, from injuring the hop. The truth of this may be determined by experiments in our climate and country.

† Hops had better be gathered before they are quite ripe, than remain till they are over ripe ; for then they will loſe their ſeed by the wind, or on being handled. The ſeed is the ſtrongeſt part of the hop, and they will loſe their green colour, which is very valuable.

them, for dew is apt to make them mould. They ſhould be dried as ſoon as poſſible after they are gathered; if not immediately, they muſt be ſpread on a floor to prevent their changing colour. The beſt mode of drying them is with a fire of charcoal, on a kiln covered with hair-cloth, in the manner of a malt-kiln.* The fire muſt be kept ſteady and equal, and the hops ſtirred gently. Great attention is neceſſary in this part of the buſineſs, that the hops be uniformly and ſufficiently dried: if too much dried they will look brown, as if they were burnt; and if too little dried they will loſe their colour and flavor. They ſhould be laid on the hair-cloth about ſix inches thick, after it had been moderately warmed; then a ſteady fire kept up till the hops are nearly dry, leſt the moiſture or ſweat, that the fire has raiſed, ſhould fall back and change their colour. After the hops have been in this ſituation about ſeven, eight or nine hours, and have got through ſweating; and when ſtruck with a ſtick, will leap up, then throw them into a heap; mix them well and ſpread them again, and let them remain till they are all equally dry. While they are in the ſweat, it will be beſt not to move them for fear of burning them. Slacken the fire when the hops are to be turned, and increaſe it afterwards. Hops are fully dried when their inner ſtalks break ſhort, and their leaves are criſp and fall off eaſily. They will crackle a little when their ſeeds are burſting; and then they muſt be taken from the kiln. Hops that are dried in the ſun, loſe their rich flavor, and if under cover, they are apt to ferment and change with the weather, and loſe their ſtrength. Fire preſerves the colour and flavor of hops, by evaporating the water, and retaining the oil of the hop. After the hops are taken from the kiln, they ſhould be laid in a heap to acquire a little moiſture to fit them for bagging. It would be well to exclude them

* Mats made of the ſplinters of walnut, or aſh, will anſwer the purpoſe, and come cheaper than hair cloth.

from the air, by covering them with blankets. Three or four days will be ſufficient for them to lie in that ſtate. When the hops are ſo moiſt that they may be preſſed together without breaking, they are fit for bagging. Bags made of coarſe linen cloth, eleven feet in length, and ſeven in circumference, which hold two hundred pounds weight, are moſt commonly uſed in Europe: but any ſize that beſt ſuits may be made uſe of. To bag hops, a hole is made through a floor large enough for a man to paſs with eaſe: the bag muſt be faſtened to a hoop larger than the hole, that the floor may ſerve to ſupport the bag. For the convenience of handling the bags, ſome hops ſhould be tied in each corner to ſerve as handles. The hops ſhould be gradually thrown into the bag, and trod down continually till the bag is filled. The mouth of the bag muſt then be ſown up, and the hops are fit for market. The harder hops are packed, the longer and better they will keep; but they muſt be kept dry. In moſt parts of Great-Britain where hops are cultivated, they eſtimate the charges of cultivating an acre of hops at forty-two dollars, for manuring and tilling, excluſive of poles and rent of land. Poles they eſtimate at ſixteen dollars per year, but in this country they would not amount to half that ſum. An acre is computed to require about three thouſand poles, which will laſt from ſix to twelve years, according to the kind of wood uſed.

The Engliſh growers of hops think they have a very indifferent crop, if the produce of an acre does not ſell for one hundred and thirty-three dollars, and frequently they ſell for two hundred dollars; and have been known to riſe as high as four hundred dollars. In this country experiments have been equally flattering. A gentleman in Maſſachuſetts, in the ſummer of 1791, raiſed hops from one acre of ground that ſold for three hundred dollars; and land is equally good for hops in this ſtate. Upon the loweſt eſtimate we may fairly compute the nett profit of

an acre of hops to be eighty dollars, over and above poles, manure and cultivation.

There is one circumſtance farther we think has weight, and ought to be mentioned. In the Engliſh eſtimate, the expence put down, is what they can hire the labor done for by thoſe who make it their buſineſs to perform the different parts of the cultivation. A great ſaving may therefore be made by our farmers in the article of labor; for much of it may be performed by women, children, and the aged. Add to this, we have another advantage of no ſmall moment. In this country the hop harveſt will come between our two great harveſts, the Engliſh and Indian, and interfere with neither: but, in England, the grain and hop harveſt interfere, and create a great ſcarcity of hands, it then being the moſt buſy time in the year. It is found by experience, that the ſoil and climate of the eaſtern ſtates are more favorable to the growth of hops than Great-Britain; they not being ſo ſubject to moiſt foggy weather of long continuance; which is moſt injurious to hops. And the ſouthern ſtates are ſtill more favorable to the hop than the eaſtern ſtates, in point of flavor and ſtrength. The ſtate of New-York unites ſome advantages from either extreme of the union. The cultivators of land in this ſtate have every inducement which policy or intereſt can afford, to enter with ſpirit into the cultivation of hops. We ſhall therefore be enabled to ſupply our own demand, and export this article, inſtead of ſending abroad for all we uſe; and no crop that can poſſibly be put on land, will yield an equal profit. This culture will require but little land—the labor may be performed at intervals, ſo as not to interfere or injure the other buſineſs of the farm, by the aged, women, and children.

There is no farmer of this ſtate but may, with eaſe, raiſe from one quarter of an acre, to as much as three or four acres of hops, the advantage of which would

in a few years, be moſt ſenſibly felt, both by the individual concerned, and by the ſtate at large.

In the city of New-York there are at preſent a number of very large and reſpectable breweries eſtabliſhed, and new ones are continually erecting. Theſe breweries not only ſupply this ſtate and the ſhipping with beer, but alſo the greateſt part of the four eaſtern ſtates; as there is not a ſingle brewery, of any conſequence, in all thoſe ſtates. It is, however, a fact leſs mortifying than true, that moſt of the malt, and all the hops the New-York breweries uſe, are raiſed in the eaſtern ſtates. If the farmers of the ſtate of New-York would but make the experiment, they would find the cultivation of hops ſo much for their intereſt, that very ſoon we ſhould have hops in ſuch plenty, as not only to ſupply our own conſumption, but for exportation. In ſome parts of this ſtate, there is exiſting a ſtill farther inducement for the growing of hops; which is this, the ſoil is unfriendly to the cultivation of the apple-tree, and beer is an excellent ſubſtitute for cyder, affording more nouriſhment than either rum or cyder, and is a much greater preſervative of health and morals.

Eſſay on ſome Perennial Graſſes; with the moſt Approved Method of their Cultivation, and various References to their proper Soil:

By Peter De La Bigarre, *Eſq.*

NON OMNIS FERT OMNIA TELLUS. *Virg.*

AMONGST a great number of graſſes uſed for artificial paſtures, I thought it my duty to ſelect thoſe which I preſume the moſt ſuitable to this ſtate, and moſt friendly to cattle, as far as I am able to judge, from my experience of the country.

LUCERNE,	ESPARCET,	CLOVER,
SAINFOIN,	PIMPERNEL,	VETCHES.

This eſſay will be extended only to four of the perennial, conſidering the three others as annual, and leſs uſeful, which therefore require a ſeparate treatiſe.

LUCERNE.

It is not true that lucerne can grow every where: it requires a light but ſubſtantial ground, not too dry nor too wet: it delights in a deep and gravelly ſoil, or rich ſand, where it may root down eaſily, rather upon a level ſpot, than on mountains or declivities. As much as poſſible I would chuſe a ſituation ſheltered by woods or hedges from the cold winds in the winter, and from burning breezes in the ſummer.

Tillage and Sowing.

The ground intended for lucerne, muſt be ploughed twice before winter, fifteen inches, or at leaſt a foot deep.

In the latter end of March you plough it again, and dreſs it with a harrow before the day of ſowing: the ſeed is buried in the ground by the harrow, taking care to fix chatwood or branches under and betwixt the teeth, in ſuch way as to facilitate the covering of the ſeed, without going too deep into the ground.

There are two ways for the ſowing of lucerne: the firſt, by itſelf, which is the beſt: the ſecond, mixed with barley or oats—but obſerve not to mix lucerne with any other perennial.

Whether lucerne is ſown by itſelf, or mixed with barley, take twenty pounds weight for an acre. If you chuſe to ſow it with barley, take the exact meaſure of the quantity of barley which you are uſed to ſow upon one acre—then put in that meaſure twenty pounds of lucerne ſeed, fill it up afterwards with the barley, that proceſs will eſtabliſh the juſt proportion.

If you intend to ſow lucerne by itſelf, fill up the meaſure with ſand or aſhes over the above-mention-

ed quantity of ſeed, that method makes the ſowing eaſier and more regular.

When your barley is ripe, you may mow it as cloſe as poſſible to the ground without any danger of hurting the young plants of your lucerne, of which you cannot expect but a very indifferent crop the firſt year. Don't let cattle feed upon it at that time.

The ſecond year will give you two crops. In the beginning of the third year, as ſoon as the winter is over, you muſt harrow your lucerne about two inches deep when the ground is yet moiſt, in two or three different directions, in order to root out the weeds: Never mind nor be uneaſy if your lucerne is torn to pieces by that hard dreſſing; the more it is torn the better it will grow: this is a fact of long experience, upon which you may rely.

Manure.

After the above dreſſing, you may manure your lucerne with greater advantage, by ſpreading over ſome new ground or mud taken from creeks and ſwamps, or employ ſome pulverized gypſum.

The beſt manure for lucerne which I know, is the dung of fowls and pidgeon-houſes, well dried by the ſun, and reduced into powder; but it ſeems very ſcarce, and too difficult to be got in this country, although a great deal leſs of this laſt manure would be required, as in the proportion of one to nine. Dung of cows, horſes, or of any other cattle, ought to be rejected as bad manure, upon lucerne—becauſe they bring with them ſuch a quantity of weeds, as to poiſon the beſt lucerne in the courſe of two years.

Produce.

The third year the lucerne has acquired its full ſtrength, then upon a common average one acre will produce, *viz.*

The firſt crop,	2500	weight.
The ſecond,	1400	do.
The third,	600	do.

After the third crop, let it be fed upon by your cows all the remainder of the fall.

Such a piece of lucerne will laſt from nine to ten years: but however great may appear the profit of that culture, there is a greater one after the lucerne is worn out: I mean the richneſs afforded to the ground by the roots of that plant; which is ſuch, that the firſt year the lucerne has been ploughed up, I was never able to raiſe wheat, which grew too rich, tall, luxuriant and lodging. Inſtead of wheat, then you muſt ſow barley or oats.

Mowing.

The moſt proper time to get good and tender forage, reliſhed by the cattle, is to mow lucerne when in full bloſſom, or a little before the ripeneſs of the ſeed.

Another advantage of mowing early, is to have the weeds cut down, which otherwiſe would come to ſeed, and ſpread over the field.

When the weather is clear, one or two days are ſufficient to dry your lucerne hay; and by ſpreading over each row a thin bed of any ſtraw (that of oats and barley is the beſt) you may carry your lucerne to the barn, without any danger of being heated or rotten. The ſtraw ſo intermixed with lucerne, receiving the juicy emanations of it, becomes more palatable, and it is eaten like the beſt hay by the cattle. It would be needleſs to obſerve what increaſe of food that proceſs affords to a farm.

Diſorder.

In ſome uncommon ſummers, it happens that lucerne is attacked by caterpillars, or other inſects. When this is the caſe, and you perceive the ſtems and the leaves turning pale, yellow, or fading, the only and beſt remedy is to mow inſtantly your lucerne, which will ſoon grow again, fine and free from thoſe inſects.

SAINFOIN.

It may be aſcertained that ſainfoin, conſidered like hay, is one of the moſt friendly foods to neat cattle; horſes are particularly fond of it in the winter, when it furniſhes them ſo ſtrong a nouriſhment as to be a good ſubſtitute for oats.

It grows upon any kind of ſoil, except upon ſtony ground. Its moſt advantageous quality is to ſucceed in the pooreſt land, ſandy loam, and upon declivities, of which it keeps the ground.

Tillage and Sowing.

Two tillages as deep as poſſible, according to the nature of the ground; never mind if the plough turns up a part of that reddiſh and yellow ſtratum which they call unvegetable among the farmers.

It is ſown by itſelf, or mixed with the ſame grains pointed out for lucerne: but as the ſeed of ſainfoin is bigger than that of lucerne, the mixture muſt be in proportion.

Manure.

Any kind of well-rotten dung, or any pulverized gypſum, will increaſe the crops, though it may do without. When it is three or four years old, a good harrow-ſcratching cannot fail to be of ſervice.

Produce.

It will be according to the ſoil, commonly two crops. The firſt richer than that of any other graſs: The ſecond leſſer in the proportion of one to nine—becauſe you cannot mow the ſainfoin as early as you do lucerne. If you wiſh to make a ſtrong food for your horſes, you muſt wait till it is grown up in ſeed for the firſt crop.

Mowing.

I would recommend the method pointed out for lucerne, as the moſt profitable.

Longevity.

Sainfoin is in full ſtrength the third year, and will laſt from nine to twelve years, ſometimes more, according to the ſoil and expoſition.

Diſorder.

It is not liable to be deſtroyed by any kind of inſect, as far as I know from an experience of fifteen years. Its mortal enemy is a flock of ſheep, particularly when it is young.

ESPARCET.

This graſs, unknown I believe in England, may be claſſed among the plants of perennial kind, and more like the ſainfoin than any other. It has ſome peculiar advantages—It may be ſown in every month of the year, except in time of ſnow or froſt, growing upon every ſoil, it roots very well through ſtiff clay, ſtony or hard red gravel, provided the ground has been ploughed as deep as poſſible.

Manure.

Like for ſainfoin.

Produce, Mowing, &c.

Though it would afford a crop nearly like that of ſainfoin, I preferred keeping it for conſtant paſture; and in that way I have ſeen one of twenty-three years old, producing as fine graſs as any young meadow. It is remarkable for keeping well the ground upon declivities.—No diſorder.

PIMPERNEL.

This perennial plant, which I would rather call immortal, on account of its long continuance, highly deſerves to be introduced into this country. It is capable of withſtanding the ſevereſt cold, as well as heat; beſides it grows as well upon the top of mountains as in plains and valleys: it delights above all

in light, ſandy, gravelly or calcarious ſoils. This vivacious plant has the power of deſtroying every other kind of graſs or weeds. It keeps green all the winter, and the cattle are ſo fond of it, that whenever they ſmell it, they ſoon remove the ſnow to get at it. Whether eaten dry, green, or wet, it never hurts the cattle: Its nutritive qualities differ from thoſe of other plants of the ſame claſs; for inſtead of heating, it refreſhes. Give me leave to ſubmit to you a ſingle inſtance, recommending this plant better than any other deſcription.

In the province of Berri it was known and remarked long ago, that all the ſheep who fed upon certain meadows full of wild pimpernel, had finer wool. In conſequence, a gentleman of my acquaintance took the trouble to cultivate a piece of ground with that pimpernel, and his ſucceſs has confirmed beyond any doubt our preceding remark. He bought twenty poor wretched ſheep, who never had before but coarſe and common wool. In the courſe of the firſt year the alteration in the wool was ſenſible, and the little flock was bearing a good and healthy appearance. Not further than at the third ſhearing, the wool was ſo fine that it fetched one-fifth above the common price.

In ſhort, this plant, whether as hay or in graſs, affords the moſt reliſhing food to horſes and cows; theſe laſt give much better milk.

Tillage and Sowing.

The ground muſt be well ploughed at leaſt ſix inches deep, once in the latter end of September, the ſecond time in October. Then twelve pounds of ſeed will do for an acre, if the ground is good:—add to it as much ſand or aſhes, and ſow it as you do lucerne.

Manure.

It may do without, but gypſum and any kind of dung would by all means increaſe the crops.

Like lucerne, this graſs will receive a great benefit, by being ſcratched with a harrow, every other year in the beginning of March.

Produce,

Commonly three crops, like lucerne, if it is reſerved for hay.

Mowing.

Like lucerne.

Diſorder.

None, as far as I know.

Longevity.

Immortal.

On White Mulberry Hedges.

BY THE SAME.

THE urgent neceſſity of planting hedges, as the only cheapeſt ſubſtitute to our fences which are growing dearer and more ſcarce every year, being felt and acknowledged, it remains to aſcertain the beſt kind of plants for hedges.

Upon this ſubject nothing can lead us to a good choice, but practice and example: therefore we muſt conſult Europe, where there is a great variety of what they call live fences. We there remark a great defect which was brought on by chance, or by the careleſſneſs of the firſt planters: that is, the hedges are made of different kinds of wood, and ſuch (it is proved by experience,) never anſwer half ſo well as thoſe of one and the ſame kind of wood. Therefore in the firſt inſtance, it will be eaſy to avoid that defect in our future plantations.

White and hawthorn, red elm and birch trees, are reckoned the beſt plants, and are more generally uſed

for hedges : The latter is recommended by its flexibility to be interwoven from the foot to the top, ſo as to become impaſſable. Either of thoſe plants will make a better hedge when planted in two rows eighteen inches diſtant from each other.

Twelve years ago, an induſtrious gentleman of the agricultural ſociety of Lyons, made a trial which deſerves our utmoſt attention : He planted hedges of mulberry, which beſides the above mentioned advantages, produce a greater one, being *the food for the ſilk worm.*

As it would be beyond the limits of my ſubject, to enter on any particulars about the raiſing of ſilk ; I ſhall attempt in another communication to lay before the ſociety an eaſy and clear method upon that rich branch of agriculture : It is ſufficient at preſent to ſhew the connection of it with our *mulberry hedges*, as a ſtrong inducement to give the preference to that kind of hedges.

I ſhall aſk leave only to relate a curious inſtance of the utility of thoſe hedges.

The 20th of April, 1784, after the ſilk worms were out of their firſt mewing, about twelve hundred of them were ſpread upon a mulberry hedge. They remained expoſed to the intemperance of the ſeaſon ; which, having been very cold, left little hopes of their ſucceeding : We took care to viſit them every day, and particularly during the violent rains and moſt boiſterous weather : they were never ſeen very ſenſible to the cold, nor exerting themſelves for ſhelter : On the contrary, they remained motionleſs, and bore well the ſtorm : In ſhort, neither the cold nor the heat appeared to make much impreſſion upon them. They were free from the diſorders commonly attending thoſe tended with the greateſt trouble and care in our houſes.

Notwithſtanding the bad ſeaſon, which we might ſuppoſe would have killed them all, out of thoſe twelve hundred, we gathered four hundred and fifty

cocoons, which proved to be the fineſt ſilk ever raiſed in France: theſe cocoons gave two pounds ſeven ounces raw ſilk. Then the reſult is the loſs of about two-thirds, which will appear very inconſiderable to thoſe who know by experience that a greater proportion is loſt in the common way of breeding at home, where the fifth part only ſucceeds.

To return to the manner of planting mulberry hedges: Round the field to be encloſed, dig up a ditch three feet wide and two feet deep: the longeſt roots of the young plants being cut off near the hairy fibres, muſt be planted about eighteen inches deep, at the diſtance of three or four inches from each other: After the ditch is filled up, every ſhoot muſt be cut at the height of two or three inches above the ground. Whether the plant is big or not, there is no matter, provided it is at leaſt one year old. Obſerve only to give the preference to the white mulberry, as the beſt for the food of the ſilk worms.

The time to plant theſe hedges is in the beginning of April. The ſecond year it is neceſſary to cut again the ſhoots about ſix inches above the ground, in order to give more ſtrength to the ſprouting branches, which will form a pretty ſtrong hedge the third year; and at laſt grow ſo thick as to be impaſſable by any cattle. It may be twiſted and interwoven a great deal eaſier than the hawthorn. If you chuſe to make a ſtronger hedge, you may plant it in double rows, as it is uſed by people who do not mind that little expence.

It is well underſtood, that for three years the young hedge muſt be defended againſt the cattle by a proper fence like every other plantation of the kind, and the ground muſt be worked and kept clear from weeds.

No wood grows quicker than the mulberry; and, what is more intereſting to this country, no kind of inſect whatſoever, not even the locuſt touches the limbs nor the leaves of the mulberry: it ſeems reſ-

pected by all deſtroying inſects, and reſerved only for the ſilk worm.

I forgot to mention, that in caſe the breeding of the ſilk worms could not ſucceed in the open air, and left intirely to the chance of the weather upon the hedges; yet it is obvious that the gathering of the leaves for the breeding at home, will be always eaſier from thoſe hedges than from high mulberry trees.

You may remark, that after the firſt leaves of mulberry have been employed in the ſpring to feed the ſilk worms, the other leaves of the fall may be gathered; and when dry, they afford in the winter a good food for the cattle—above all to the cows who give milk.

The objection will be, the difficulty of getting thoſe young mulberry plants in this country to make hedges with. They will coſt ſomething; but they may be got from ſeveral nurſeries in New-Jerſey, and Long-Iſland. However, any farmer not wiſhing to go to that expence, may eaſily raiſe thoſe plants from ſeeds, in the following way;

Gather all the ripe berries fallen down under the white mulberry tree: put them for two days in a dry place, where they muſt be turned up and down, for fear they ſhould be heated: After which you muſt waſh them with your hands in a tub, pouring over ſome water from time to time, in order to ſeparate the ſeed from the muſt. Let then the water ſettle for a quarter of an hour; and all the uſeleſs particles floating over, will be taken out. You muſt repeat the above waſhing, till the ſeed is well diſengaged and pure. The beſt ſeed being the heavieſt, will ſtay always at the bottom of the tub.

This being done, ſpread all the good ſeed to dry upon a bit of linen: when dry, keep it in a cloſet till the ſeaſon fit for ſowing. Obſerve that that kind of ſeed never keeps good longer than one year.

The moſt proper time to ſow the mulberry, is in the beginning of April. Some people pretend that

the ſeed ſucceeds well when ſown in the very trench made for the hedges. But a long experience teaches that it is better to raiſe the plants in a nurſery where the ground is rich and well manured. You will chuſe for that purpoſe a place ſheltered from the north and cold winds. This place muſt be digged and prepared before the winter. The beſt way is to make a bed four feet wide only, in order to be able to water it, and pick the weeds out, without trampling upon the ſeed bed. Before you water the ſeeds, you muſt ſpread over ſome light ſtraw to prevent the ground from becoming too hard, which otherwiſe would be an obſtacle to the riſing up of the young plants.

The plants are fit to be tranſplanted the following year in the trenches intended for the hedges, according to the manner and at the time above mentioned.

The mulberry grows in every ſoil, but it delights in a rich ſandy ground.

Letter from ROBERT R. LIVINGSTON, Eſq.
Preſident of the Agricultural Society of New-York,
to ARTHUR YOUNG, *Eſq.*

THE pleaſure and information I have received from your various publications on agricultural ſubjects, induce me to contribute my mite to the ſupport of your annals—a work that has given me great ſatisfaction, though many parts of it are calculated only for the meridian of England. The happineſs of man depends ſo much upon the advancement of agriculture, that every new diſcovery, every improvement by which the fruits of the earth are increaſed, ſhould be thrown into the common ſtock; and the man who has been ſo fortunate as to make them, ſhould thank God that he has been enabled,

in ſome ſort, to repay to ſociety the debt he owes them for the benefit he has himſelf received from the diſcoveries of others, to the great maſs of which his own, however important, will be inſignificant.

Nothing in this view can be more repugnant to the principles of humanity and ſound philoſophy, than thoſe reſtrictive laws by which nations endeavor to confine partial advantages to themſelves, at the expence of the reſt of mankind, who happen to be ſeparated from them by the adoption of other forms of government. The deliberate ſelfiſhneſs of ſuch national meaſures leads to the ſame ſelfiſhneſs in individuals, and, in both, ſets at defiance the great law of Chriſtianity: "Thou ſhalt love thy brother as thyſelf."

I fell into theſe reflections, by reading over the report of the committee for the inſpection of ſheep in the iſland of Great Britain;—it has greatly undeceived me with reſpect to the quality of that animal in England, which, from the high penalties on their exportation, I was led to believe infinitely ſuperior to thoſe we poſſeſs; whereas I find ours at laſt equal to the general average of thoſe in Great Britain. Moſt of our flocks are breeding flocks, and, when tolerably kept, they average two and a half pounds of wool; where well kept, the ewes three, and the wedders five pounds; and as far as I can judge from ſuch Engliſh ſheep as I have ſeen, the wool is equal to your ſhort wool, and ſells here a quarter of a Spaniſh dollar the pound: the average weight of a fat wedder is about ſixteen pounds a quarter; where they are fed through the winter on green fodder, they would doubtleſs be much ſuperior. Thus you find that all the effect of Britiſh reſtrictions on the export of ſheep, have had no other tendency than to violate the feelings of humanity, without effecting the object they have in view: Indeed I do not know whether every reſtriction has not a contrary effect from that intended, by ſtimu-

lating the exertions of thoſe who think themſelves injured, and inducing them to annex an imaginary value to the obtaining of the prohibited object. We have acquired (in defiance of their laws) ſheep from England and Spain.

I have imported ſome from Holland, which are ſuperior in ſhape, though not in ſize to either; and indeed ſo greatly reſemble your drawings and deſcriptions of Baekwell's ſheep, that I am inclined to think they have made the baſis of his flock: they are ſhort and ſquare, without horns; the head ſmall, and free from wool; the tail ſmall and pointed, about eight inches long, covered with hair, or ſhort wool; the bones very ſmall. The ram yields ſix pounds of wool, of very good quality, and about ſix inches in length. I ſend you a ſmall ſample of wool, from a ſtock of ſheep which I received from the Weſt-Indies, and which had originally no wool, but was covered with a thick coat of red hair: this is changing into wool, which I think ſuperior in fineneſs to that of Shetland, with which I have compared it; but what is very remarkable, is, that the wool is white, though the original colour of the ſheep, and the hair intermixed with the wool, is of a mahogany colour, or what is called blood-bay in horſes. I ſhall, if you requeſt it, communicate the further alteration that theſe ſheep undergo from the change of climate, as well as the nature of the mixed ſtock, as I am croſſing them with various breeds. If the wool ſhould retain its preſent fineneſs, when it increaſes in quantity, we ſhall not need Spaniſh ſheep to improve ours. You will find by the firſt part of the proceedings of our agricultural ſociety, which I directed the ſecretary to tranſmit you, that we are beginning to copy your example, and to form plans for the advancement of agriculture. The ſecond part, which is now in the preſs, will be tranſmitted to you. Since you have thought the experiments on gypſum, which I communicated

to the ſociety, worthy a place in your annals, I would juſt inform you, that I have continued to uſe it with equal effect: but what pleaſes me more, is to find that my theory, with reſpect to its operating not merely as a ſtimulus, but actually adding, by its effects on the air, to the fertility of the earth, ſeems to be confirmed by the following experiments, the communication of which is the principal object of this letter.

For two ſummers, ſeveral farmers in my neighborhood have applied it to manuring of potatoes, when they have not had a ſufficiency of dung for the whole ground they had prepared for planting, and they have all aſſured me that the product was greater from the parts treated with gypſum, than from that which they had manured with dung. It is applied to the potatoes, when they are about three inches high, at the firſt hoeing, in the proportion of about ſix buſhels to the acre. I this year tried it on two fields of buck-wheat, upon dry, ſandy ground, ſtrewing it over after the buck-wheat had attained the height of two inches. The effect upon the growth of the plant was aſtoniſhing; it averaged about four feet and a half in height, and the ſtems were of an extraordinary thickneſs. It was, however, too much lodged to produce a proportionate quantity of grain.

As both potatoes and buck-wheat are, as well as clover, of the nature of thoſe plants which draw a great proportion of their nouriſhment from the air, theſe experiments appeared favorable to my theory; but what confirms it, is a crop of oats I this year had: by ſowing the ground mentioned to be under clover, on my experiments No. 2 and 3, with oats on one ploughing, which averaged ſixty-four buſhels to the acre, notwithſtanding the natural poverty of the ſoil; and for this fertility it was certainly indebted to the clover and gypſum, which was the only manure it had; and what was very extraordi-

nary, the three-quarters of an acre No. 2, which was the pooreſt part of the field, naturally yielded better oats, as it had better clover, by nearly ten buſhels an acre, than that which was originally in much better heart.

Theſe confirmations of my theory make me regret that you had not given it a place with the experiments, ſince the principle laid down is at leaſt new, and the very refutation of it might throw light upon this moſt intereſting ſubject. The modern ſyſtem of chymiſtry, to which I own myſelf a convert, may make new names neceſſary; but change the word Phlogiſton to *Caloric*, Vitriolic to *Sulphuric*, &c. and the theory will remain as it was, which in a few words is this: That the alkaline vapours, or gazes, which float in the atmoſphere, attach themſelves to the ſulphuric acid of the powdered gypſum, form neutral ſalts, which, being diſſolved, enter into the compoſition of plants: that the earth, deprived of its acid, becomes cauſtic, and is again reduced to a ſilenite, by re-uniting with acids in the air (moſt probably the nitric) which is re-diſſolved by alkalies, and the proceſs thus continued till the calcarious earth is diſſolved or waſhed away, or devoured in its attenuated ſtate by plants: That theſe ſalts, in their ſolution, ſeize upon a certain portion of caloric in the air, deſtroy its elaſticity, compel it to depoſit the infinite variety of matters that are borne upon or diſſolved in it, and perhaps decompound the air itſelf, and render it, or part of it, food for plants.

I have endeavored, by this theory, to reconcile the various phenomena that gypſum exhibits, as you will find, by recurring to the paper I refer to. But, after all, I conſider this as a mere ſyſtem—and, like all other ſyſtems, to be viewed as the ſport of imagination, unleſs ſo far as it ſhall appear to be confirmed by experiments.

On thus opening a correſpondence with you, who are here, Sir, conſidered as the great parent of Britiſh

agriculture, I conform myſelf to the wiſhes of the corporation for the promotion of agriculture and uſeful arts, eſtabliſhed in this ſtate, in which I have the honor to preſide; as I do alſo when I aſſure you of their readineſs to communicate any information relative to the object of their inſtitution which you may think worthy of inquiry.

On the Excretory Duct of the Feet of Sheep.

By ROBERT R. LIVINGSTON, *Eſq.*

Preſident of the Society.

THE diſeaſes of animals and their cure, depending upon an accurate knowledge of their ſtructure, I take the liberty to mention an obſervation upon that of ſheep, which indeed was ſo obvious, that I conceived that no farmer, and much leſs the naturaliſt that treats of this uſeful animal, could be ignorant of it; till I found on ſpeaking on the ſubject to many experienced huſbandmen, and particularly to many members of this ſociety at a full meeting, that only one of the members had attended to the circumſtance I allude to: Nor is it noticed by Buffon, or by Liſle, who treat largely on the diſeaſes of ſheep. This muſt be my apology to thoſe who ſhall find no novelty in the following remark: The legs of ſheep are furniſhed with a duct, which terminates in the fiſſure of the hoof; from which, when the animal is in health, there is ſecreted a white fluid, but when ſickly, theſe ducts are ſtopped by the hardening of the fluid.

I have in ſome inſtances found, that the ſheep were relieved, merely by preſſing out the hardened matter with the finger, from the orifice of the duct in each foot; perhaps it may in ſome caſes be proper to place their feet in *warm water*, or to uſe a *probe*, or *hard bruſh* for cleanſing this paſſage.

May not the ill-health of ſheep in wet or muddy paſtures, be in ſome meaſure aſcribed to the neceſſity of keeping the duct I have mentioned free and open?

On the Effects of the Shade of Trees upon Vegetation.

Extract of two Letters from the Honorable ROBERT R. LIVINGSTON, *Eſq. to Mr.* MITCHILL.

Clermont, *17th Sept.* 1792.

DEAR SIR,

THE plans that I had projected of agricultural improvement for this year, have been fruſtrated by the building a country houſe, which has occupied my attention and the laborers that I uſually employed upon my farm, ſo that I ſhall be able to offer nothing on the ſubject of experimental huſbandry that will merit your attention, unleſs it be an obſervation which I have frequently made, but with more attention this year than before, and which may, I conceive, if properly purſued, lead to important conſequences. I mean the baleful effect of the *ſhade* (if I may ſo call it) of ſome trees, upon the vegetation of corn. I will ſtate the facts as they have appeared to me, and you will the more readily comprehend my ideas. I planted maize on the weſt ſide of a young wood, conſiſting of oaks, poplars, a few cheſnuts, and a large mulberry ſomewhat advanced into the field; the ſhade made by the riſing ſun, extended nearly acroſs the field, and was not entirely off until about ten o'clock; I remarked, that as far as the ſhade of the cheſnut reached, the corn was extremely injured; it was yellow and ſmall; the conical ſhape of the morning ſhade from particular trees, might be traced a conſiderable extent, in the ſickly appearance of the plants; the black-oaks were

likewiſe injurious, but leſs ſo than the cheſnut; the poplars very little ſo.—Near the mulberry tree, the corn was covered by its ſhade for a very long time every morning, and though not ſo large as that which had more ſun, maintained a healthy appearance. To what cauſe are we to attribute this phænomenon? it is certainly not the *mere abſence of light or heat;* for in this caſe the trees would have been equally injurious, or rather the mulberry would have been moſt ſo. It is not *to any dropping from the tree;* for the corn grew *under* none but the mulberry. It is not to *any effluvia from the trees;* for this would either be emitted in circles, or wafted irregularly by the wind; whereas the ſhape of the ſhade was plainly traced upon the corn. Were I permitted to form a conjecture upon this extraordinary circumſtance, I ſhould conclude, that the miſchief was not occaſioned by the *ſhade*, but by thoſe rays of light that actually paſſed through the tree, either *perforating the leaves* (for none of them are perfectly opake) or *being brought into contact with them;* and that this light ſerved as a menſtruum, to diſſolve certain parts of the tree noxious to corn, and as a vehicle to convey it in the direction of the rays (which neceſſarily are that of the ſhade.) As the injury is done in the line in which the direct rays of light paſs through the tree, it muſt follow, that neither *air* nor *water* are ſolvents for this body; for if they were, it would be wafted in different directions. If this idea is juſt, what a field does it open for important diſcoveries? To how many *medical purpoſes* may this new menſtruum be applied? The only properties of vegetable ſubſtances with which we are acquainted, are thoſe that we collect from the application of the whole plant, or a ſolution of it in water or ſome other liquid. By the firſt of the means, we may indeed obtain thoſe parts which *light only* can diſſolve, but mixed with various ſubſtances which may probably counteract the effect. By the laſt, this matter, whatever

it may be, cannot be obtained. Many plants that are conſidered as poiſonous, when ſubjected to this trial, may be found to contain a ſalutary ſubſtance, and the rays of the ſun paſſing through them, be made to convey health and vigor. Should theſe conjectures be verified by experiment, the *phyſicians* may again claim *Apollo* for their patron, after having long abandoned him to *the poets*, to whom indeed they will ſeem, in ſome ſort to aſſimilate themſelves, when inſtead of *pills* and *powders*, they ſhall preſcribe *zephyrs* and *ſunbeams*. Will not this fact, in ſome meaſure, account for another, which ſeems well eſtabliſhed by Dr. Ingenhouz, to wit, that the effluvia of plants are ſalutary in the light, and hurtful at night? The facts I have ſtated are confirmed by a variety of intelligent farmers, to whom I mentioned my obſervations. General Schuyler, upon my expreſſing my ſurprize at the circumſtance, told me, he had long ſince obſerved, that the ſhade of the *black-oak* was particularly noxious to wheat. To indian corn, it appears to be leſs ſo, than cheſnut. The *ſhade* of the locuſt (I am compelled to uſe this term, though as you ſee it does not expreſs my idea) is well known to be extremely beneficial to graſs grounds.—Think of ſome mode of *trying its effects upon the animal ſyſtem.*

Clermont, 11*th Auguſt*, 1793.

DEAR SIR,

I HAVE, ſince I ſaw you, been confirmed in my conjectures relative to effect of light paſſing through certain ſubſtances, by the following experiment: I ſelected a ſpot of ground, of one hundred yards long, and eighteen wide near the centre; on the weſt ſide (the length of the ground laying from north to ſouth) was a tall cheſnut tree, which I trimmed up, ſo as to make the ſhade of the head fall at ſome

diſtance from the tree, when the ſun was about forty degrees from the horizon: on the ſouthweſt end of the ground ſtood a cheſnut and a black oak. On the ſouth end, and only eighteen yards from them, grew a clump of mulberry trees, and one large apple tree; the ſhade caſt by the two laſt from 9 to 11 o'clock, nearly meeting with that caſt by the oak and cheſnut from 1 to 3. This ground I ſowed with buck-wheat, on the 1ſt of July, from a perſuaſion, that the *mere abſence of a portion of light*, at a ſeaſon of the year when the days are very long, and the ſun inconveniently hot (particularly to buck-wheat, whoſe bloſſoms drop off without producing grain, if the heat of the ſummer's ſun is for two or three days untemperated with clouds) could not be very prejudicial to this plant, or at leaſt that the ſhade of trees at each end, which were equally thick, would be, in that caſe, equally prejudicial. *The contrary, however, is the fact.* Gypſum having been ſtrewed over the field, the whole has ſuch a degree of luxuriance as I have never before ſeen; the buck-wheat is upwards of four feet high, as well where it is ſhaded by the *mulberry and apple trees*, as where it has *no ſhade*. Where the ſhade of the *black-oak* falls, the colour is leſs healthful; but the ſpots ſhadowed in both parts of the field by the *cheſnut trees*, if mown at this time (becauſe now in bloſſom) would not, I am ſatisfied, produce half the weight that the ſame ſpace of ground would yield in any other part of the field, not even excepting that ſhaded by the apple and mulberry trees, which is however inferior to the reſt of the field; this I attribute to the apple ſhade (though it is too much united with the mulberry to be diſtinguiſhed) ſince I have before found, that the ſhade of the apple tree was hurtful to Indian corn. You will obſerve that my experiments *laſt year*, were drawn from *cheſnut trees* ſtanding on the *eaſt ſide* of a *field of corn: this year*, from thoſe which grow on the *weſt* and *ſouthweſt ſide* of the *buck-wheat*.

This experiment which I have made with attention under the moſt favorable circumſtances, as well with reſpect to the poſition of the trees, the nature of the vegetable, and the ſeaſon of the year, have confirmed me in the theory I hinted to you, that the injury which ſome vegetables receive from the ſhade of certain trees, is not owing ſimply to the diminution of light, but either to a change the light undergoes in paſſing through them, or from its diſſolving and becoming the vehicle of ſome ſubſtance noxious to certain plants contained in the tree, through which it paſſes. There are few facts in phyſics that do not admit of ſome uſeful deductions; I have taken pains to eſtabliſh this, that you, or ſome other chymiſt of more leiſure and equal information, may make them.

On Caſt-Iron Plough-Shares.

By Col. JOHN SMITH.

DURING the laſt ſpring and ſummer, in ploughing my fields, I made uſe of the caſt plough-ſhare, which was exhibited to the agricultural ſociety, at their meeting during the laſt ſeſſion of the legiſlature, and found it to exceed my moſt ſanguine expectations. It is caſt in the form of a Dutch ſhare, after the beſt model that could be procured by the ſociety, with this exception, that the edge is not complete, and not ſo wide by about three inches, as it will be when finiſhed with the falſe edge, which is made of wrought iron or ſteel, and faſtened on with rivets. The ſoil in which I uſed this ſhare, was light and free from ſtone, though I believe, with careful uſage, it will anſwer in any other ſoil, although the ſame may be ſtony and incumbered with ſtumps. This plough-ſhare beſides anſwering every purpoſe of thoſe made of wrought-iron, will

laſt to plough as much as two of the latter, before it is worn out, the caſt-iron being nearly as durable as ſteel before it is hardened. By this experiment, it is very obvious, that the caſt plough-ſhare will be very beneficial to farmers, and ought to be encouraged by this ſociety. They may be had of Mr. Peter T. Curtenius, in New-York, either with or without the edge, which is made of wrought iron or ſteel.

Obſervations on Conſtructing a Green-Houſe.

By JOHN W. WATKINS, *Eſq.*

THE building ſhould be ſunk in the earth from two to four feet, in proportion to the ſize of the houſe, and according to the nature of the ſoil; as clay retains moiſture, and of conſequence produces damps, in ſuch ground it ſhould not be ſo deep. The height ſhould not exceed twelve feet from the exterior ground, by which it will be leſs expoſed to high winds. The width ſhould not exceed ſixteen or eighteen feet, as the ſun's rays are at that diſtance from the glaſs very feeble. A ſouth front is well known to be the true one, but advantage ſhould be taken of glaſſing as much of the eaſtern end as poſſible, for the benefit of the morning ſun. The front ſhould decline northward from a perpendicular with the horizon, ſo as the angle made thereby with the horizon, will at noon day in winter, bring the rays of the ſun to ſtrike the glaſs at right angles, and the roof ſhould deſcend the oppoſite ſide without a break. By this poſition of the roof and glaſs, the rays of the ſun are thrown upon every part of the inſide of the houſe, and the whole becomes heated thereby; more of the rays are alſo introduced into the building, and when the ſun produces moſt heat during the day, there is no reflection of its rays, and at other parts of the day, the reflecting angle being

obtuſe, does not powerfully caſt off the rays. The inſide of the rafters of the roof, ſhould be lined with boards and the ſpace between that and the roof filled with a mixture of ſtraw, ſand and clay made into mortar; boards ſhould be uſed in preference to ſhingles, as making fewer breaks in the roof, leſs opportunity is given for the admiſſion of cold air. The reſidue of the building may be of ſtone or brick work, or a frame building filled in with bricks, and no flooring of any kind upon the ground. Shutters on the outſide are ſufficient, and it is preferable to have them hung on hinges, as the leaſt troubleſome, to the common practice of ſliding ones; they ſhould be made to fold into the ſpaces between the windows.

Before putting the plants into the houſe, the bottom ſhould be covered with bark from a tan-vat, about a foot deep, according to the depth the building is ſunk in the earth.

The advantages propoſed by this method of conſtructing are, the leſſening the expence of building, that the heat of the ſun being ſufficient to warm the houſe, the trouble and expence of warming it by a ſtove is avoided, which unleſs very carefully attended, the plants may be injured by too much heat, and are always by the ſmoak that unavoidably makes its way out of the pipes. It would be proper nevertheleſs, to make arrangements in conſtructing the houſe for uſing a ſtove, in caſe a long ſucceſſion of cold cloudy days by obſcuring the ſun, ſhould reduce the heat in the houſe, below that degree of temperature neceſſary for preſerving the plants, which is a caſe that will ſeldom happen, as one clear day will warm the houſe ſufficiently to admit its being ſhut up for ſeveral days.

Plants in a houſe of this kind require leſs water, and do not ſuffer for the want of atmoſpheric air. It is probable, as the earth is charged with electric fluids, as vegetable ſubſtances are known conductors of it, that the bark by its fermentation, not only generates

heat, but ſerves as a mean to produce out of the earth, an atmoſphere for the plants, ſufficient with ſuch atmoſpheric air as will find admiſſion, to ſupply the quantity exhauſted, by the daily rarefaction occaſioned by the ſun's heat.

A green-houſe has been uſed upon this conſtruction in this ſtate, without having had the leaſt occaſion of being heated by fire. The plants in the ſpring were remarkably thrifty; tropical fruit ripened in it during the winter, and young fruit formed on the trees. It required no other care, than now and then watering the plants, and ſhutting the windows as ſoon as the ſun left them.

Experiments on Wheat, Clover and Lucerne; ſubmitted to the Society for promoting Agriculture and uſeful Arts, by JOHN STEVENS, *of Hoboken.*

THE cultivation and management of a field of about ten acres:

No. 1. About three and a half acres, part of the above, is a loamy ſoil, which having a N. W. expoſure, is rather inclined to be wet and cold in the ſpring. In the month of May of 1792, planted it with Indian corn, manured in the ordinary way, with farm-yard dung in the hills. The crop was a good one. The latter end of October, cut it up cloſe to the ground, and carried it off. Then gave the whole a good dreſſing—part with farm-yard dung—part with heated aſhes, and part with ſtreet dirt; gave it one ploughing, and harrowed in three and a half buſhels of wheat. In the month of March following, ſowed the whole thirty pounds of red clover; and on an acre of the drieſt part inclining to ſand, ſowed at the ſame time about eight pounds of lucerne ſeed. The wheat turned out a much better crop than I had expected from its appearance in the

fall; for it was manifeſt to the eye, that it had not been ſufficiently ſeeded. My overſeer has rendered me an account of eighty-one buſhels of clean wheat; but as the crop had after harveſt been put up in a barrack, where great depredation had been made on it by poultry, hogs, &c. and conſiderable waſte accrued from threſhing on an open temporary floor, I ſhould ſuppoſe the product might be fairly eſtimated at one hundred buſhels, which is at the rate of about twenty-eight and a half buſhels per acre. Although the ſeaſon was remarkable dry, the clover came on after harveſt, at an aſtoniſhing rate, and as I was under the neceſſity of keeping up the field, it was not paſtured as uſual. In the beginning of October, the clover was cut, and notwithſtanding the ſtubble prevented it being cloſe, the product was as nearly as I could eſtimate at leaſt four tons. One four ox load was taken into the barn; the remainder was taken immediately from the field to the boat, and delivered from thence into my ſtable in New-York. I have kept a pair of horſes and a cow on it ſince the beginning of January, and expect it will laſt me till April.

As to the part ſown with the lucerne ſeed: On the far greater part of it the ſeed failed altogether, and the few ſolitary plants that here and there made their appearance, were evidently ſtunted and overpowered by the clover.

No. 2. About three acres were ſown in the ſpring 1792, with oats, and produced a tolerable good crop. In the ſpring 1793, it was manured with ſtreet mud, and ploughed, I believe but once, and ſown with barley and clover; over a part of it, lucerne ſeed was alſo ſown, but in what proportion of ſeed per acre I cannot now aſcertain. The crop of barley was a miſerable one. It came up very thin, and, as the ſpring was wet, the manure brought forward an ample crop of weeds, with which at harveſt the ground appeared to be completely covered: how-

ever, towards fall, the clover began to make a pretty good appearance. Although the lucerne has come up better than on No. 1, it is too thinly ſcattered to promiſe hope of any thing like a full crop. That part of No. 2, on which the lucerne was ſown, is more ſandy than No. 1.

No. 3. About three acres, may be called a ſandy ſoil. In 1792, it was partly in corn, and partly in potatoes. In the ſpring 1793, it was well manured with ſtreet mud, and ploughed, I believe, but once, and ſowed with barley about the laſt of April. Twenty-five pounds of lucerne ſeed was at the ſame time ſown over the whole of it, without any clover ſeed. The barley turned out very indifferently, though better than No. 2. Although the ſoil was ſandy, it was much infeſted with weeds.

The lucerne, in ſome parts of the piece, came up pretty well, though I ſhould ſuppoſe not thick enough for a full crop the enſuing ſeaſon. In many parts, it ſtands very thin, and in ſome places it has failed altogether, particularly in thoſe places where the manure had been thrown in heaps out of the cart, the weeds had almoſt entirely overpowered both barley and lucerne. The lucerne was not paſtured till after the clover was taken off of No. 1, which was early in October. It was then in many parts of the field upwards of two feet high, and in full bloom. And though I am perſuaded in my own mind, it would not have yielded ſo large a crop as the clover, even if it had ſucceeded equally as well, yet, as it was, the paſture it afforded was very conſiderable. The whole field, from the time the clover was off, till late in November, ſupported five head of fatting cattle, and three horſes. The cattle throve greatly, although at that ſeaſon the paſtures were every where in the neighbothood, almoſt entirely dried up, owing to a ſevere and long continued drought.

I ſhould by no means have troubled the ſociety with any thing reſpecting theſe experiments in the

preſent ſtage of them, as lucerne is ſaid to require at leaſt two years to attain to any degree of perfection; but although theſe experiments, as yet, can afford no concluſive inferences reſpecting the ultimate profit of a lucerne crop, yet I apprehend ſome important deductions may be drawn from them.

1. From the almoſt total failure of the lucerne on No. 1, we may fairly conclude, that the ſeed was committed to the ground *too early* in the ſeaſon, eſpecially as the clover that was ſown with it ſucceeded very well.

2. The indifferent appearance of No. 2, may, I preſume, be attributed principally to the want of a proper melioration of the ſoil. A fit matrix for vegetation was thereby, in the firſt place, wanting, and, in the next place, the plants of thoſe ſeeds which did vegetate, were nearly ſuffocated by weeds.

3. The luxuriant growth of the lucerne on No. 3, would countenance a concluſion that lucerne may ſucceed very well when ſown on barley *without* clover.

4. Upon the whole, theſe experiments, as far as they go, indicate, that lucerne ought not to be ſown *early* in the ſeaſon—perhaps midſummer may prove the fitteſt time for ſowing it. That every care ſhould be taken to render the ground as mellow and as free from weeds as poſſible, and that therefore it would be moſt adviſeable to prepare the ground the ſucceeding year, by a crop of potatoes, pumpkins, or other horſe hoed crop, with which a generous coat of manure ſhould be laid on, ſo as to ſupercede the neceſſity of manuring the lucerne, except, perhaps, with a top dreſſing of aſhes, &c.

Perhaps no one ſubject of rural economy will eventually prove of more importance to the American agriculturiſt than the culture of lucerne. From the habits of the plant it appears admirably fitted to our climate. It requires heat and endures drought—And on a ſoil properly adapted to it, it will laſt from a dozen to twenty years in full perfection.

I mean the enſuing ſpring to make further experiments on this noble plant, and to note minutely the progreſs of thoſe I have already began—and hope I ſhall be able to furniſh the ſociety with a more ſatisfactory detail of facts on this ſubject than is contained in the preſent memoir.

On the Cultivation of the Tall-Meadow-Oats (avena elatior) *for Paſture and Hay;—and on Gypſum and Stone-Coal as a Manure.*

Communicated by the Rev. Dr. HENRY MUHLENBERG, *of Lancaſter,* (Pennſylvania) *to Dr.* MITCHELL, *dated May* 15, 1793.

DEAR SIR,

MY brother Frederick Auguſtus Muhlenberg, informed me you would be glad to ſee ſome ſeeds of the graſs he mentioned and recommended to you at New-York. I have cultivated the ſame a number of years from imported ſeed, and find it, after a great many trials of pretty near all other graſſes, the earlieſt, lateſt, and beſt graſs for green fodder and hay. It bloſſoms in the middle of May, the ſame time with the common red clover, and the ſeed ripens a month after. Horſes, it is true, do not like it green, at leaſt not all of them, but eat it in hay. Horned cattle prefer it to all other graſſes. It will grow beſt in clover ſoil, and the leaves are from two to four feet high before it bloſſoms; in the bloſſom the ſtalk riſes from five to ſeven feet. It ought to be cut in bloſſom about the end of May or beginning of June, and will yield an abundance of ſweet good hay. The ſeed may be ſown in the fall or ſpring, with or without grain, and muſt be bruſhed in or lightly harrowed. If mixed with clover, it will make

uncommon good upland meadow. The name of the graſs is *avena elatior* (Linnæi) the *wieſenhafer franzoſiſch raygras* of the Germans; or, in Engliſh, *tall-meadow-oats*. A very good figure and deſcription is given in *Scherber's Abhandlung und Abbildung der Graſer, vol.* 1. *tab.* 1.

I ſend you ſome ſeed, and adviſe you to ſow it in a good ſpot of your garden. I began with leſs ſeed than I ſend you, and have now laid down ſeven acres for it.—We have a number of other good graſſes which deſerve to be cultivated. According to my trials, they range in this order :—1. Tall-meadow-oats, or tall-oat-graſs (*avena elatior*, imported.) 2. Tall-feſcue-graſs, (*feuſtuca elatior*, native.) 3. Meadow-fox-tail-graſs, (*alopecurus pratenſis*, imported.) 4. Meadow-ſoft-graſs, or Yorkſhire graſs of the Engliſh, (*holcus lanatus*, native.) 5. Timothy or meadow-cats-tail-graſs, (*phleum pratenſe.*) 6. Rough-cocks-foot-graſs, (*dactylis glomerata*, native.) 7. Engliſh or common rye-graſs, (*lolium perenne*, imported.) 8. Sweet-ſcented-vernal-graſs (*anthoxanthum odoratum*, imported.) 9. Reedy-cinna (*cinna arundinacea*, native.) 10. Broom-graſs, two ſpicies, (*bromi*)—All thoſe ſhould be cultivated with Timothy in our bottoms or meadows which can be watered. As for upland meadows I would prefer clover (*trifolium pratenſe*) lucerne (*medicago ſativa*) and ſaint foin (*hedyſarum onobrychis.*) The firſt is certainly the beſt preparation for a good crop of wheat, if well managed.

For many years, I have wiſhed that our American patriots might join hands, and the literary and intelligent men of this country might have more intercourſe. How much could be done for the proſperity of theſe ſtates! We do not know the half of our riches. Agriculture will, I hope, be our chief ſtudy, and be the means to raiſe the Americans, amongſt the firſt nations of the earth. Manufactures are now indeed in their infancy, but the many good materials

we have in this country, promiſe more encouragement if we learn to know and eſteem them.

The gypſum has had many fair trials in our neighborhood, and on dry poor lands has always anſwered our expectations. I could never obſerve any effect on dry or well-manured lands. Clover, oats and Indian corn agree beſt with it. Apple-trees have likewiſe been much benefitted. We ſow it early in the ſpring three or four buſhels to an acre, before we expect rain. I made a number of experiments with gypſum, and never found any harm; but we muſt import it; and as an American, I wiſh a ſubſtitute. I think pulverized *lime-ſtone* is of the ſame ſervice, and ſome of our lime-ſtones are eaſy pounded, and uſed in the ſame manner as gypſum. If *Mr. Meyer* (the firſt that uſed gypſum and recommended it ſo warmly to the world) is not miſtaken, *Stone-coals pulverized, are ſafer and go farther in meliorating the lands than gypſum.* I heartily wiſh ſome of your agricultural friends would make an experiment with our *American ſtone-coal*; four hundred pounds are neceſſary to one hundred and eighty ſquare perches. Should theſe experiments prove ſucceſsful, as I do not doubt, what a noble acquiſition would our ſtone-coals be! At preſent they are too dear, when the Suſquehanna is improved, I expect they will be exceeding cheap. I have a very valuable treatiſe on theſe mineral manures, written lately by a German chemiſt, *Ruckers.*

Review of WILLLIAM CURTIS'S *Pamphlet on Graſſes.* *By Dr.* MITCHILL.

THE ſmall work of *William Curtis*, containing practical obſervations on the Britiſh graſſes, beſt adapted to the laying down, or improving of meadows and paſtures; to which is added, an enumeration of

the Britiſh graſſes, has been received by the ſociety; and the following abſtract made from it, is offered to ſuch of their fellow-citizens as cannot procure the original: Mr. Curtis begins by obſerving, that much meadow and paſture land may be rendered infinitely more valuable than it is at preſent, by the introduction of ſome of their beſt graſſes, and obſerves, that neither the ſoundeſt reaſonings nor beſt directed premiums have ſucceeded in exciting the huſbandman to collect and cultivate ſeeds of this ſort, and laments ſeriouſly that many of the uſeful hints in *Anderſon's eſſays on agriculture and rural affairs* are rendered abortive from his want of botanical information. He thinks it extraordinary, that out of more than an hundred graſſes, ſtrictly ſpeaking, growing in Britain, rye-graſs, however inadequate for the purpoſe, is ſtill the principal one employed in laying down lands. Out of this variety Mr. C. has ſelected ſix, which he is confident will do all that their natural graſſes can do; they are choſen from among thoſe that conſtitute their beſt paſtures; moſt of them being early, all of them productive, and adapted to ſuch ſoils and ſituations as are proper for meadows and paſtures.

After cautioning his readers not to expect wonders, he gives a conciſe account of each of the ſix graſſes with a copper-plate annexed. They are the following: 1. Sweet-ſcented-vernal-graſs, (anthoxanthum odoratum.) 2. Meadow-fox-tail-graſs (alopecurus pratenſis.) 3. Smooth-ſtalked-meadow-graſs (poa pratenſis.) 4. Rough-ſtalked-meadow-graſs (poa trivialis.) 5. Meadow-feſcue-graſs, (feſtuca pratenſis.) 6. Creſted-dog's-tail-graſs, (cynoſurus criſtatus.) The order of their flowering is the ſame with that of their preſent enumeration. And he obſerves, that the meadow-fox-tail and rough-ſtalked-meadow-graſs are fitteſt for moiſt lands; the meadow-feſcue and ſweet-ſcented-vernal, for land either moiſt or moderately dry; and the ſmooth-ſtalked-meadow-graſs and creſted-dog's-tail, for dry paſture.

The culture of theſe graſſes being particularly recommended in preference to others, Mr. C. goes on to give a conciſe account or character of twenty-ſeven other graſſes, derived, as he ſays, from fourteen years culture and obſervation. Among theſe he mentions the tall-meadow-oats as being early, productive, and affording a plentiful after-math.

The author proceeds next to give practical directions for ſowing the ſeeds which he recommends. From the numerous applications made to him by a variety of gentlemen, for graſs-ſeeds, it appeared incumbent on him to do ſomething which might gratify them, and render the public an eſſential ſervice. He has accordingly provided aſſortments of ſeeds put in packets, ready for ſowing; each kind of ſeed being in that proportion which ſuits beſt. At the end of this chapter, Mr. C. obſerves, that common worms, by "throwing up great quantities of earth, contribute greatly in meadow lands to prevent the growth of moſs, as well as to afford freſh ſoil for the roots of plants to ſhoot into, and for ſeeds to vegetate in:" He calls them "the natural diggers and dungers of land; worm caſts being nothing more than the dung of the worms."

Then follows a botanical arrangement of the Engliſh graſſes in twenty-five genera, with the trivial and Engliſh names annexed; and the work concludes with an appendix, containing hints relative to the improvement of meadows, in reſpect to their produce, bateableneſs and early growth.—The packet of graſs ſeeds may be had at No. 3, St. George's Creſcent, near the Obeliſk, Black-Friar's Road, London, price half a guinea.

On the Decay of Apple Trees.

From a Letter of WILLIAM DENNING, *Eſquire, to Mr.* MITCHELL, *dated December* 22, 1793.

DEAR SIR,

IT is undoubtedly of conſequence to the farmers of this country, as well as to others, that the cultivation and preſervation of apple trees, be duly attended to. It is therefore with great concern, that I have marked the progreſs of a diſorder, prevailing and increaſing in this valuable and uſeful tree, for many years, without having it in my power to deviſe a remedy.

As no obſervations have as yet appeared on this intereſting ſubject, I hope my giving you the trouble of my remarks thereon may be attributed to my wiſh for the preſervation of thoſe trees; which I hope may be effected by ſome ingenious invention or diſcovery adapted to the novelty and urgency of the diſeaſe. I firſt obſerved it in my orchards in the vicinity of Hudſon's river, north of the Highlands, in the year 1780. I have ſince obſerved its baneful progreſs further ſouth. And, if I am not miſtaken, it is ſpreading rapidly. I have obſerved it alſo, attacking pear trees and quince trees, to the total deſtruction of them in a few years: and as theſe trees are of a ſlow growth, the loſs, is of courſe irreparable to the preſent proprietors.

A long time this diſorder baffled my moſt critical reſearches. As I obſerved the young, remote, and tender ſhoots firſt affected. I traced the malady to the ſpot where the ſap ceaſed to flow, but could diſcover no external cauſe. On the ſecond year I found the boughs wounded deeper, and progreſſing yearly, the trees continued to ſicken, and in ſix or ſeven years died. It is to be obſerved, that every ſpring the trees appear in full vigour (except the limbs already periſhed from the former years attacks)

and continue ſo until the latter end of June, or beginning of July, when ſuddenly the leaves wither, turn red, and ſoon fall off; the whole tree appears ſick, and the fruit full of ſpots, and unpromiſing; hence the indifferent appearance of many of our apples brought to market for ſale; few of them being fair and ſmooth as they formerly were.

As ſoon as the leaves fall off, as above deſcribed, it will then appear how far the tree is affected for this ſeaſon.

Finding all my efforts to diſcover the cauſe in vain, I hazarded ſeveral experiments; among others, two years ſince, I laid bare the roots of two favorite pear trees in the month of October, and left them ſo until May following: one of theſe trees was ſo injured, that I had no hopes of its recovery. Laſt year they ſhewed few or no additional ſymptoms of the diſeaſe, were very full of fruit, and had a great ſupply of new ſhoots; this year, both trees were very full of fruit, though again they diſcovered ſymptoms of the diſorder, but not in ſo great a degree as in former years.

Still purſuing my enquiries, I have had ſome apple trees cut down, that were far decayed. In the firſt I diſcovered two worm holes, running perpendicular from the tap-root up through the heart; theſe holes were large enough to admit a common pipe-ſtem, and reached about fourteen inches above the ſurface of the ground, and from each hole I ſcrewed out a worm. All the other trees I found perforated with worm-holes, ſuch as have been already deſcribed, and in ſome to the number of eight or ten. Having extracted ſome of theſe worms entire, I find them *nearly* of the ſame ſize and ſpecies of thoſe ſo common and ſo well known to be the conſtant attendants on peach trees; indeed ſo ſimilar are they to thoſe worms, that I am of opinion, they are of the ſame kind.

I have loſt ſeveral valuable trees by this moſt per-

nicious worm, and my whole orchard is in a ſtate of decay. This diſorder appears to me to be of a more ſerious nature than any thing that has ever infeſted orchards. The canker-worm, only deſtroys the leaves and fruit for the ſeaſon, and perhaps every fourth year, if not attended to when a fly; but this worm radically deſtroys the tree itſelf. I have inquired of many farmers in my travels, whoſe orchards I have obſerved in this ſtate, what they ſuppoſed the cauſe of it? they generally anſwered, the trees were blaſted by lightning, and this I found to be the prevailing opinion; none of them, of courſe, thought of ſearching for the true phyſical cauſe.

As I am confident I have diſcovered it, the next ſtep is to find a remedy; as I have not yet ſucceeded, I ſubmit it to the conſideration of the agricultural ſociety, whether a publication of the real cauſe of the diſorder may not lead to a diſcovery that may tend to ſtop the ravages of this worm; and perhaps induce many, whoſe intereſt it is to preſerve their trees, to attempt to ſecure them from its fatal attacks. To lay bare the roots of a large orchard, every autumn, would undoubtedly be attended with great trouble and expence, yet even that would be eaſier than to raiſe another orchard. And I have beſides, obſerved very young trees, even in nurſeries, ſicken from the ſame cauſe.

French and Engliſh Meaſures compared.

By PETER DE LA BIGARRE, *Eſq.*

IT may not be uſeleſs to be acquainted with the references of the French meaſures to thoſe of this country, as far as it can help farmers in their reſearches on various improvements and proceſſes made in foreign agriculture.

We find often in different treatiſes the names of

meaſures which are not evaluated according to thoſe uſed where we live : therefore, without ſuch calculated references we are unable to determine our judgment or to balance an exact reſult, whether advantageous or not.

The Engliſh foot ſtands for eleven inches three lines and 25-100 of a line of a French foot.

Fifteen ſquare French feet are equal to ſeventeen Engliſh. Two acres of different extent are generally uſed in France ; one for arable lands, the other for woods and foreſts.

The firſt is compoſed of one hundred rods, but each rod of eighteen feet ſquare, which gives nine hundred ſquare fathoms to an acre.

The ſecond contains one hundred rods, each rod of twenty-two feet ſquare, which gives thirteen hundred and forty-four ſquare fathoms.

Thus an Engliſh acre containing eleven hundred and thirty-five ſquare French fathoms, has two hundred and nine fathoms leſs than the foreſt-acre abovementioned.

The Engliſh yard contains only two French feet five inches nine lines.

The Engliſh mile of ſeventeen hundred and ſixty yards is equal to about eight hundred and twenty-five French fathoms, as the fathom is equal to ſeventy-ſix 3-4 Engliſh inches.

The Engliſh gallon of grain contains two hundred and twenty-two cubic French inches.

Two gallons make a peck, which is the quarter part of a buſhel, and contains four hundred and forty-four cubic French inches.

The Engliſh buſhel, as uſed in London, contains ſeventeen hundred and ſeventy-eight cubic French inches ; the French buſhel, as uſed in Paris, contains ſix hundred and forty cubic inches and 71-100 of an inch.

Thus ſomething leſs than three French buſhels or

what they call half a mine in Paris, is equal to an Engliſh or ſtatute buſhel.

An Engliſh quarter containing eight buſhels is equal to one French ſeptier, eight and 1-2 buſhels.

TABLES of Progreſſion, to reduce various French Acres, and to ſhew how many Feet and ſquare Fathoms are contained in the ſquare Rod, according to its ſurface from 18 to 22 Feet.

The Rod having feet.	The ſquare Rod contains		
	Feet.	Fathoms & Feet.	
18	324	9	0
19	361	10	1
20	400	11	4
21	441	12	9
22	484	13	16

How many Feet and ſquare Fathoms are contained in a ſquare Acre, according to its ſurface from 18 to 22 Feet.

The Rod having feet.	The ſquare Acre contains		
	Feet.	Fathoms & Feet.	
18	32400	900	0
19	36100	1002	28
20	40000	1111	4
21	44100	1225	0
22	48400	1344	16

PART III.

TRANSACTIONS, &c.

Addreſs delivered before the Society in the Aſſembly-Chamber, in the City-Hall at New-York, the evening of November 8, 1796.

By JAMES KENT, *Eſq.*

Mr. PRESIDENT, *and*
Gentlemen of the Agricultural Society,

IN endeavoring to diſcharge the duty which has been aſſigned to me of pronouncing an anniverſary addreſs in honor of this inſtitution, I have occaſion to regret my great inexperience in the art of which this ſociety is the profeſſed patron. And this regret becomes the more lively from a view of the intelligent farmers with whom I am connected, and from a juſt appreciation of the importance of agriculture, as the abſolute means of our ſubſiſtence; as the ſource of nutriment to the arts; of freedom, energy, commerce and civilization to mankind, and in ſhort, as the firmeſt baſis of national proſperity.

Nothing therefore will, or ought to be expected from me in relation to the practical part of rural economy. I will however obſerve, that the image of tranquility and happineſs, which under governments of only a tolerable adminiſtration, every where

appears among the cultivators of the earth, muſt always preſent itſelf to the eye of benevolence, with attractive charms.

It is certainly a precious advantage attached to the agricultural life, that it leads to no intemperate avidity for wealth, and inſpires bold and generous ſentiments of freedom and independence. Although the remark be perhaps too ſtrong, that cities are the graves of the human ſpecies, yet it is obviouſly true that the farmer's life, from the uſe of wholeſome air, abundant exerciſe, moderate pleaſures, and ſimple diet, is by far the moſt favorable to health, longevity and population.

But I ſhall not ſtay to examine the effects of agricultural purſuits on the moral and political character of a people. My purpoſe on the preſent occaſion is to take a ſummary view of the actual condition and capacity of our country, and from what we now are and the means we poſſeſs, to infer the importance of continuing and increaſing our individual and aggregate efforts to meliorate, extend and conſummate our *Agriculture*, *Arts* and *Manufactures*, thoſe great ſources of ſocial enjoyment.

The progreſs in bettering our condition, which has been made generally throughout the United States ſince the concluſion of the late war, and eſpecially ſince the auſpicious eſtabliſhment of their government, is far beyond the uſual progreſs of nations, and furniſhes concluſive proof of the powers we poſſeſs, and our means to exert them. Our population has increaſed one fourth part. Settlements have penetrated the vaſt northern and weſtern interior of the Union, and approached in ſeveral inſtances to the borders of Canada, of the St. Lawrence, of the lakes Ontario and Erie, and of the river Miſſiſippi; new roads have been opened and conducted the ſtreams of inland emigration, old roads in the more ſettled parts of the country have been improved, and particularly on the recent eſtabliſhment of turnpikes, which have

been attended with ſuch ſucceſs as ſtrongly to recommend them to imitation. The beds of rivers have been opened and cleared, and the very uſeful art of bridge building carried on with unuſual ſpirit and enterprize. The junction of diſtant ſtreams and waters has been a ſubject of frequent contemplation, and ſometimes boldly and ſucceſsfully attempted. Canals and locks have been introduced upon the falls and rapids of our rivers, and they have enabled us in ſome inſtances to realize, and in many more to anticipate, great abridgment of the expence, and great increaſe in the facility and rapidity of inland navigation. The increaſe of our exports, and particularly within the laſt four years, as well as the very thriving condition of our towns and cities, in ſize, in buildings, in uſeful and elegant improvements, atteſt the accumulation of the produce of our land and labor, or in other words, the ſolid ability and efficient capital of the country.

Theſe improvements have been accompanied and accelerated by a proportional increaſe of knowledge and public ſpirit. Unuſual efforts have been made in the practical and mechanical branches of rural induſtry. Experiments have been tried and their reſults made known. Societies for theſe purpoſes have been inſtituted, a general correſpondence and mutual communication encouraged, premiums have been offered and beſtowed as an incitement to genius and ſucceſsful diſcovery, pamphlets containing advice and experiments have been circulated, and theſe and many other circumſtances announce a large augmentation of the national capacity and exertion.

Theſe remarks are applicable to the Union at large, they are peculiarly ſo to the ſtate of Pennſylvania and to our own, and although the former has hitherto taken the lead in theſe patriotic exertions, and has enjoyed the juſt reward of her policy in the ſuperior quantity and frequently in the ſuperior quality of her products; yet it is certain that this ſtate is at pre-

ſent animated with an equal ſpirit, is making ſimilar progreſs; and with like advantages in every other reſpect, ſhe has pre-eminent advantages in the goodneſs and quantity of her land, and the convenience of her navigable waters.

Let us caſt an eye for a moment on our geographical poſition. Bounded on the ſouth by the Atlantic Ocean, and poſſeſſing this excellent and diſtinguiſhed ſea-port, the great outlet to the Weſt-India and European markets, and waſhed on the weſt and northweſt from the 42d to the 45th degrees of lat. by the Great Lakes and the river St. Lawrence, which gives it water communication with the provinces of Canada, this ſtate is moſt happily ſituated for the tranſport of its productions, and for its commercial operations abroad. Nor are its advantages for interior trade leſs ſtriking and peculiar. There is no part of the union, and probably no country in the world of a ſimilar extent, interſected by a nobler ſtream for the purpoſes of inland navigation than the Hudſon. Terminating in the harbor of this city, it affords a ſafe and commodious navigation into the heart of our country for upwards of 170 miles, nor are the impediments ſuppoſed to be inſurmountable to the continuance of its navigation to the falls of Fort-Edward, a diſtance of 215 miles from the city of New-York. The N. E. part of the ſtate for the ſpace of more than 120 miles is waſhed by the waters of Lake Champlain, which affords not only an eaſy acceſs to the Canadian markets now thrown open to the United States, but by the aſſiſtance of Wood and Fort-Edward creeks, we may hereafter be able, and it is to be preſumed from the force of our growing ability, and the aid of the mechanic arts, at no very diſtant period of time, to waft the produce of its borders into the navigable waters of the Hudſon.

The Mohawk, the ſecond river in the ſtate in ſize, and among the firſt for the richneſs of the ſoil through

which it flows, although at preſent unnavigable at its mouth, yet from Schenectady to Fort-Stanwix, a diſtance of nearly one hundred miles, it is well fitted for batteaux navigation, and by the exertions of the weſtern canal company the only impediment to its navigation in this long diſtance is now ſucceſsfully ſurmounted. This river is at preſent uniting by a canal with the waters flowing into the Oneida lake, and a communication will be formed from thence not only with lake Ontario, but with the ſeveral leſſer lakes and ſtreams in the midſt of the military and Geneſee lands, a country now included in the counties of Onondaga and Ontario, and diſtinguiſhed for a ſoil as rich, deep, and productive as any in the United States.

Theſe peculiar advantages of our water intercourſe have indeed been rather unfavorable to the improvement of our roads and bridges. Although much has been done in a few years paſt with the patronage of the legiſlature, yet we are ſtill greatly inferior in this intereſting branch of police to our ſiſter, our emulous and enterpriſing ſiſter, Pennſylvania, who has been under the neceſſity, and has moſt wiſely obeyed the dictates, of paying the firſt attention to her public highways. And it is an axiom of political ſcience not to be conteſted, that well conſtructed and well preſerved roads, are ſure indications of a wiſe government and a ſucceſsful induſtry.

From a country like ours, profuſely bleſſed by the hand of nature, enjoying ſo convenient an outlet, being ſo abundantly watered and covered with a rich ſoil, and immenſe quantities of unimproved land at market on cheap and eaſy terms, it was to be expected that agriculture and commerce ſhould receive and communicate redoubled vigor, and that we ſhould make unexampled progreſs in population, wealth and improvement. Since the year 1787, eight new counties have been formed in thoſe parts of the ſtate which have been almoſt entirely reſcued

from the wilderneſs, and ſettled ſince the concluſion of our war with Great-Britain; and within the laſt ten years our population has received an increaſe of nearly 150,000 ſouls, a number which is within 20,000 the total amount of the population of the colony 1771. Our population at this time is about 400,000 ſouls, and our increaſe for ſome time to come preſages to continue uniformly rapid.

The moſt valuable products of this ſtate, and which may be called its ſtaples, are grain and proviſions, of all kinds, pot and pearl aſhes and lumber. In the three laſt articles it ſurpaſſes any of its neighbors, and in the aggregate amount of the former eſpecially in the principal articles of wheat, Indian corn, flour and ſalt proviſions, it maintains the ſecond, and is faſt approaching to the firſt rank in the Union.

The ſtaples of this and the other United States, are indeed the neceſſaries of life, and we have a never failing demand for them in foreign markets. Europe in its pacific ſtate, does not on an average produce more grain than is equal to its own conſumption, and its agriculture is ſo often and ſo fatally interrupted by war, that the food of America is neceſſary to ſupply the waſtes of ambition and cruelty, and to ſave from famine the angry nations from whom we deſcended.

The ſugar iſlands in the Weſt-Indies depend permanently upon us for their bread. Although the mother countries have reſerved to themſelves the excluſive right of ſupplying the demands of their colonies, they are often unable to do it, and their unhappy dependants are made a ſacrifice to the unjuſt reſtraints of the ſyſtem of mercantile monopoly. We are aſſured from undoubted authority, that between the years 1780 and 1787, when war for a time cut off all their helps from us, and they were unuſually diſtreſſed by hurricanes, that 15,000 negroes periſhed in the ſingle iſland of Jamaica, merely from want of food. (Edwards's Hiſt. of the Britiſh Weſt-Indies,

vol. II. p. 397. The United States are the true and natural ſource from whence the Weſt-India iſlands, the ſatelites of this great continent, muſt draw their proviſions and lumber; and however a ſyſtem of excluſion and monopoly may force things for a time out of the channel which nature preſcribed, we may be aſſured that not only reciprocal benefit, but on their part imperious neceſſity will in the end compel a ſteady as it does now an occaſional free intercourſe between them and us. On our abundant reſources it will be found, that under Providence they may place their ſtrong hopes of ſubſiſtence and relief even againſt the deſtructive violence of the phyſical elements, or of the ſtill fiercer elements of the human paſſions.

From this curſory review of our *natural* poſition and ability, we may form a reaſonable eſtimate of our capacity for improvement and for carrying to an exalted pitch the arts of peace and the means of happineſs. But there are other and equally ſolid inducements to a favorable anticipation of our future condition, and theſe are deduced from our *civil* and *political* condition as a people, and by which we are diſtinguiſhed from all other people upon the face of the globe.

1. The American farmers are lords of their own ſoil; this is a right moſt propitious to exertions and enterprize. It is a power in itſelf which muſt eventually work prodigious effects. We ſee and feel already the bleſſings of independent freeholds in the proſperity of our country; and European travellers have ſeen and admired the conſequences of them in ſcattered inſtances in Ireland, France and Germany, and placed too in a ſtriking contraſt with the poverty, deſolation and wretchedneſs of tenants, holding by a precarious or oppreſſive tenure. Nothing indeed can be more fatal to exertion and improvement, than the hard or uncertain terms on which lands are held by the actual cultivators of the ſoil in many parts of

Europe. The cottagers or laboring poor in Ireland are as much oppreſſed now as the feudal vaſſals were at any period of the middle ages; and Ireland, ſays Arthur Young, is five centuries behind England in the agricultural art.

Indolent and degraded Spain has been in the habit of importing and employing annually more than 20,000 Frenchmen to reap her own harveſts. (*Alberoni's Teſtament Politique*, p. 27.) This diſgraceful tribute, which would make a patriot bluſh, and diſown his country, is a proof of the intimate alliance between political inſtitutions and perſonal induſtry. And yet we are now told that the induſtrious province of Catalonia (in which, however, not one acre in 150 is under any ſort of cultivation) is in a ſtate of comparative improvement, becauſe tenants, by a cuſtom peculiar to that province, have a power of acquiring a permanent intereſt in land by virtue of *emfitentic* contracts. (Townſend's Travels.) As ſoon as the occupier can obtain a fixed intereſt in the ſoil on which he labors, exertion is the immediate and viſible conſequence; and cultivation aſcends the mountains and adorns the vallies of that delightful climate. So by the efforts of certain philoſophers in France, a little previous to their revolution, agriculture received an important ſpring by the law which prolonged from nine to twenty-ſeven years the term for which ſuch a leaſe could be granted, or ſhould be valid againſt every future purchaſer or proprietor of the land.

2. The Americans are happily rid of the pernicious ſyſtem of regulating induſtry by law. This ſyſtem has been the reigning taſte in Europe, and eſpecially in England for centuries paſt. In almoſt every department of buſineſs the people found themſelves controuled by the voice of power intruding into all their rural concerns, and by a code of reſtraint on the one hand, and of preference on the other, inſolently dictating the courſe of induſtry and

the path of emolument, which the keen ſteady eye of private intereſt would have much better diſcovered. The intereſts of trade and manufactures gained the aſcendancy over the cultivation of land, the induſtry of towns was preferred to the induſtry of the country, and farmers ſubmitted to be governed by manufacturers and merchants, and pay a very heavy premium for their ſimplicity and generoſity. The mercantile ſyſtem (a ſyſtem of reſtraint and monopoly) aroſe in full vigor and maturity, and gave a tone to national policy and habits of thinking. It did more; it produced ruinous wars and intolerable exactions, as if the intereſt of agriculture was only a ſecondary matter among the concerns of civil ſociety; as if farmers were fit only to be the ſlaves of ambition, and to ſupply with ſcarcely a ſoothing interval of repoſe, the prodigality of wars undertaken to ſupport the balance of trade, and to ſatisfy the jealouſy and avidity of eſtabliſhed companies.

Happily for this country, agriculture is our great leading and governing intereſt, it embraces probably eleven-twelfths of the people of the United States, and it is continually progreſſing in comparative ſtrength and importance.

But while I ſuppoſe the agricultural intereſt to be the moſt ſubſtantial intereſt in ſociety, and rejoice at its aſcendancy, I am far from wiſhing it to aſcend, and indeed it cannot, at the expence of all other departments of induſtry. It is an undoubted error to repreſent the labor employed upon land, as the only productive labor, and that the induſtry of artificers, manufacturers, and merchants is altogether barren. We muſt be content to ſay that agricultural induſtry is always productive, generally pre-eminently ſo; and that whenever the products or returns of that induſtry have been protected and left at the free diſpoſal of the hands that produced them, the people have made quick advances in all the wholeſome ſymptoms of public and private proſperi-

ty. What will be the effect of well directed efforts, and to what extent they will carry national improvement under a government of public liberty and juſtice, when the paſſion for military achievments becomes extinguiſhed in the luſtre of a nobler paſſion and purer glory; when all ſyſtems of reſtraint and preference are laid aſide, and emulation to excel in the pacific and benevolent arts becomes the predominant ſpirit, we are not prepared abſolutely to ſay. No ſuch experiment has ever been fairly made. It was ſurely never made under the frigid reſtraints and military policy of the laws of Lacedemon, or of the Agrarian laws of Rome, nor under the vaſſalage and diſorder of the feudal dominion, or the partial, unſocial and monopoliſing ſpirit of modern policy. A great deal, however, has been done under all the diſcouragements I have ſuggeſted. The natural effort which every man is ſteadily making to better his own condition is (as it has been truly obſerved) a principle of preſervation capable of preventing or correcting in many reſpects the partial and oppreſſive evils of political economy. The beſt improved countries in Europe are Lombardy and England, and they have carried cultivation to a very great extent, and exhibited in ſeveral particulars, excellent models for imitation.

Piedmont and Auſtrian Lombardy (I ſpeak of them before their recent conqueſt) have a numerous population well ſupported and employed, a great export without, and a thriving conſumption at home; magnificent roads, wealthy towns, an active circulation, and canals for mere irrigation, which are ſpectacles of equal merit and curioſity; and yet neither of thoſe countries can avail themſelves of the navigation of the Po, which flows through their territories; they are both under deſpotic governments, and Lombardy in particular has armies of idle retainers to feed, and is preſſed with the heavy burthens of a diſtant court.

Sir John Sinclair ſtated as an animating incitement to national induſtry, that there exiſted in the Britiſh dominions a greater fund of ſolid ability and uſeful information, and a greater variety of actual and efficient capital, than in any other country in the univerſe of the ſame extent and population. In all theſe particulars he was undoubtedly correct, and the wonderful extent to which improvement has been carried in England, is evidence of the exiſtence and activity of this ability, information and capital. England ſurpaſſes all other countries upon earth in the art of incloſing, manuring and tilling land, in the judicious courſe of crops, and in the breeding of ſheep and cattle: and ſuch are the reſources and ſtrength which have grown out of Britiſh induſtry, that with a population more than one-third leſs than that of France, and although France contains, with a great deal of middling land, twenty-eight millions of acres of the richeſt ſoil in Europe, Britain exceeds France in above four hundred and fifty millions ſterling of capital employed in huſbandry, and has frequently been her moſt perſevering and formidable antagoniſt. Nor has ſhe diſcovered leſs abundant reſources in the preſent war, a war without example for the extraordinary efforts it has called forth, and the terrible havoc of the human ſpecies. And all this magnitude of Britiſh improvement has grown in ſpite of the oppreſſion and checks of tythes, poor-rates, monopolies, rights of commonage, the full vigor of the mercantile ſyſtem, and the return of frequent long and exhauſting wars.

Having thus haſtily reviewed our peculiar ſituation and advantages, and what has been done in other countries which have not theſe advantages, the reſult is, that we have before us the utmoſt encouragement to exertion, and the brighteſt proſpects of preſenting to mankind a new and unexampled ſpectacle of national felicity. But I feel too deficient in the requiſite ſkill and knowledge, to be able to point out correctly in detail the particular ſteps we ought to

purſue. This muſt be reſerved to thoſe who are greater maſters in the theory, and unite at the ſame time the more ſolid accompliſhments of experimental knowledge in the agricultural art. I will take the liberty, however, to ſuggeſt generally, and that too with becoming diffidence, that we have in this ſtate, peculiar objects of attention, which ariſe out of the infant ſtate of a great part of our country, in which there are millions of acres unreclaimed from the wilderneſs, and millions of acres in the rudeſt and moſt imperfect ſtate of cultivation. In ſuch a ſituation it appears to me that the improvement of roads, the opening of new ones, the building of bridges and cauſeways, the draining of ſwamps and marſhes, the opening of ſtreams, the junction of contiguous waters, the mode of clearing land, the beſt appropriation of what is cut off, the preſervation of timber, the moſt favorable commencements of ſettlements, the objects of infant tillage, the moſt eſſential internal manufactures, and the modes of tranſportation, are ſubjects which although they may ſeldom occur in older countries, becomes with us of primary importance, give riſe to an extenſive field of diſcuſſion, and merit our particular inquiry and examination. On all theſe heads information ſhould be ſought after, collected, digeſted and diffuſed. And in reſpect to the ſtate at large, an accurate account of the quality of the ſoil and timber, of the effects of ſeaſons and of the ſtate of improvement in every county ought to be collected. Alſo the manner of cultivation, and the products of each reſpective ſoil, the nature and extent of incloſures, the ſeveral ſpecies of live ſtock, the various implements of huſbandry, the nature and effect of different manures, and of the rotation of crops, and watering of land. When we ſhall have obtained a very extenſive collection of facts, the only ſure guides in political and agricultural inquiries, the ſociety will be well qualified to aſcertain the exiſting obſtacles to improvement, and the means of remov-

ing them, as well as the new improvements that ought to be introduced.

Another intereſting object of inquiry is the effect of manufactures and commerce upon our agriculture and the advantages of their connection. It is a generally received opinion, that manufactures have a very favorable effect upon the landed intereſt, by creating a near and ſtable market for the ſurplus produce of land, and thereby adding a freſh ſtimulus to exertions in huſbandry. But there are other opinions and thoſe likewiſe fortified by facts, that manufactures are not propitious to huſbandry, that they ought not to receive any marked encouragement, that every bounty or premium beſtowed upon them is a tax levied upon other branches of induſtry, and that they will of their own accord ſufficiently grow and progreſs as the natural or neceſſary reſult of a flouriſhing cultivation. It becomes not me in this place to pronounce upon theſe important inquiries, but rather to ſubmit them to the ſuperior knowledge and penetration of thoſe to whom they are addreſſed.

I would laſtly ſuggeſt the advantage of a very extenſive correſpondence and communication on the objects of this inſtitution with ſimilar ſocieties, and with well informed individuals in the other ſtates, and on the other ſide of the Atlantic. It would alſo be highly inſtructive to procure and circulate the beſt ſelected books and official papers on experimental agriculture, and eſpecially the reports of the moſt diſtinguiſhed boards of agriculture in Europe, as many of them no doubt contain a rich fund of information on the culture and improvement of land, as well as on all the other branches of political economy. To the accompliſhment of many of theſe objects, and particularly the collection and diſtribution of books, and a ſtatiſtical account of our own ſtate, the efforts of the ſociety may be found unequal, and ſurely for ſuch purpoſes the benevolent aid of the legiſlature may be freely aſked, and will be cheerfully afforded.

ſince contributing to the enlargement of knowledge, and the perfection of the arts, is the firſt duty and the greateſt pleaſure of enlightened rulers, and a work executed on the plan I have ſubmitted, would do honor to the ſtate, and be remembered by poſterity as an illuſtrious monument of national patriotiſm, munificence and taſte.

Addreſs to the Agricultural Society and both Houſes of the Legiſlature of the State of New-York, at their Annual Meeting, in the City of Albany, February 7, 1798. By SAMUEL L. MITCHELL, *one of the Members of the Aſſembly, and one of the Secretaries of the Society, &c.*

Gentlemen of the Agricultural Society.

THE conſtitution of your ſociety having connected its meetings with the annual ſeſſions of the Legiſlature, there was ſome apprehenſion among a number of the members, that the change of the ſeat of government from the city of New-York to Albany, would be attended with conſequences very injurious to its views and intereſts. It is true that many of its moſt valuable and zealous ſupporters, from their ſettled reſidence in the ſouthern parts of the ſtate, are neceſſarily withheld from attending the meetings in this place. Yet I feel a high degree of ſatisfaction in beholding ſo conſiderable a body of the gentlemen who compoſe the ſociety, aſſembled from remote counties on this occaſion, and enabled by the ſuffrages of the people to meet at ſo great a diſtance from their homes, their colleagues, who reſide in this central part of the commonwealth.

The interruption of the regular meetings has not,

however, put a ſtop to uſeful employment and communication. A variety of occurrences connected with the objects for which this aſſociation was formed, has come to my knowledge; and theſe I ſhall attempt in a conciſe manner to lay before you.

Since the premiums you adjudged to the moſt approved manufacturers of certain ſorts of coatings and blankets, as well as for the beſt ſamples of raw ſilk, the narrative of the commiſſioner appointed to examine mineralogically the banks of the Hudſon and the neighboring country, has been made out. One of the leading objects of this undertaking you remember to have been, to inquire whether the country contained any conſiderable quantity of coal, within a reaſonable carting diſtance from any landing on the river. It is to be regretted that no diſcovery of importance, relative to this article, was made; and it is to be feared that the vaſt maſſes of granite and ſlate which form the ſolid fabric below, of the part of the earth which we inhabit, contain little or no coal. Nature which has beſtowed upon us ſo many other favors, ſeems to have been ſparing in regard to this. The excurſion was, however, in many reſpects ſucceſsful; and ſome new and important facts were aſcertained by the commiſſioner which threw great light upon the hiſtory and theory of the earth. An account of theſe I ſhall cauſe to be laid before you.

In purſuit of ſimilar information, and to examine the vegetable and animal productions of this ſtate, Profeſſor Barton, of Philadelphia, has ſince taken a tour through the counties on the North-river and the Mohawk, and returned to Philadelphia by the way of Geneva and Niagara. From the reſearches of ſo reſpectable a naturaliſt, I had much to expect; and accordingly I communicated freely with him in converſation before he ſet out from the city of New-York, and have learned by letters received ſince his return, that ſo conſiderable a body of new matter

occurred to him, that he intends to publiſh an account of his tour and diſcoveries. This you may expect to ſee in print ſome time during the current year.

A number of miners or perſons ſkilled in the detecting and working of metallic veins and ores, have, as I have been informed, travelled extenſively through the ſtate from ſouth to north in queſt of thoſe kinds of mineral treaſure. Fortunately for our peace and happineſs, no ſources of gold and ſilver appear to have been detected. It is to be hoped our country contains none but thoſe of productive labor and active induſtry.

On the ſubject of manures there has been a good deal of valuable experiment and ſpeculation. Mr. Kirwan's excellent pamphlet was forwarded to the ſociety by a member of the Britiſh board of agriculture; ſince which time I have been favored by Dr. Dickſon, late of Dublin, with the laſt volume of the tranſactions of the royal Iriſh academy, which contains this memoir. On peruſing it, there appeared to me to be one memorable defect; there was very little written on the *azote* of the modern philoſophers, or the principle of putrefaction, as a fertilizing ingredient in ſoils, or a nutritive material of plants. So conſiderable an omiſſion appeared to me to deſerve a ſupplement; and accordingly I wrote an addition to the work, on the deficient article, which I have forwarded to the author in Ireland. It is very remarkable that ſo obvious and well known a ſubſtance as this ſhould have eſcaped the particular notice of agriculturaliſts ſo long.

By the politeneſs of the Preſident of the Britiſh board, a very conſiderable number of their original county-reports have been forwarded to the ſociety. Many of theſe have been ſometime in circulation among the members. They exhibit in an eminent degree the public ſpirit and admirable induſtry of the perſons concerned in the undertaking. For

ſome of theſe ſuitable acknowledgments have been made by our Preſident; and a letter to Sir John Sinclair on the ſubject of manures, was written and forwarded by the ſecretary. This you will have an opportunity of ſeeing. One object of it was, to remedy a defect in their report, ſimilar to that in Mr. Kirwan's eſſay.

Finding in ſuch publications as theſe and others that have from time to time come to hand, that one of the moſt operative ingredients in animal and vegetable manures, *(azote)* was in a great degree overlooked or omitted by European writers, I deemed it worth the while to inquire into it a little more particularly myſelf. In this undertaking there has been a developement of much new and precious information.

Fortunately, in proſecuting the ſubject, the important, though much neglected, ſcience of chemiſtry, which in my earlier days I had ſtudied with ſome care, enabled me to labor on through diſcouraging and ſeemingly inſuperable difficulties. The compoſition and qualities of ſoils and manures being only to be underſtood and explained upon chemical principles, there was a neceſſity of reviewing what had been done already, in order to comprehend what remained to be done.

The vague and incorrect language of this ſcience had been new modelled in 1787, by the French academicians, and had been adopted by the greater part of learned Europe. On examining their table of nomenclature to find how words had been adapted to expreſs ideas, it was very ſoon apparent that the right underſtanding of the ſubject of manures required not only a knowledge of chemiſtry as then underſtood, but actually the fabrication of a language upon exact and logical principles, to be the vehicle of true and correct ideas.

In conſtructing ſuch a language, and gaining for it an eſtabliſhment and currency, prejudice and pride

made formidable oppoſition. But though words were coined, yet being ſtamped in the mint of truth, ſcarcely any body heſitates to receive them at the full value for which they were emitted. With a language thus exactly adapted to convey an idea of the thing intended by it, there might be naturally expected ſome progreſs in agricultural reſearch beyond the labors both of Ruckert and Dundonald.

By the aſſiſtance of ſuch an apt form of words, animal and vegetable organization have become more intelligible. The theory of putrefaction is better comprehended. The analyſis of corrupting bodies has been more carefully attended to; and of courſe, a more correct idea of the nature and qualities of the manures formed from theſe, has been obtained. Among other things it has become manifeſt how the ſepton or principle of putridity is evolved or ſet looſe on the earth's ſurface.

As decaying bodies through corruption turn to manures and fertilize the ſoil, where vegetables grow and where the putreſcent matter is not too abundant, ſo where too great a quantity of putrefying materials are accumulated, or where growing plants do not abſorb or decompound their ſeptic or azotic combinations, an exhalation of a deleterious kind is found to eſcape into the atmoſphere, to render it unwholeſome to man and ſome other animals, and to excite according to its virulence and duration, various forms of epidemic diſtempers, making ſome of the Atlantic cities almoſt deſolate, and ravaging with deſtructive violence many parts of the interior country.

On tracing the progreſs of putrid bodies and their unwholeſome vapors from their origin and duration, to their decline and extinction, it has been ſufficiently aſcertained that by means of the vegetable economy, the ſubſtances whence offenſive and noxious ſteams proceed, are decompounded or taken out of circulation and manufactured anew into forms replete with organization and life.

Thus the ſubject of manures when well underſtood, explains the occaſional epidemic influence of the atmoſphere, as well as the growth of vegetables and many of their peculiar qualities; and theſe again when fully comprehended, reflect light upon the economy of farming, in their uſe and application; upon the police of cities, in preventing their baneful vapors from getting afloat in the air; and in the healing art, by enabling its practiſers to preſcribe and direct by ſure rules, what in a given caſe ought to be done. Theſe new views of this branch of ſcience have ſhewn a more intimate connexion than ever was before known to exiſt between meteorology, farming and phyſic.

In the hiſtory of facts illuſtrative of the preceding remarks, it becomes me to mention thoſe occurring among our own members, on the operation of putrid fiſhes in affording food for plants. Wheat, rye and maize are exceedingly promoted in their growth and productiveneſs by the ſeptic matter of the quickly-corrupting fiſh commonly uſed for manure. Yet it is equally true and deſerves your particular attention, that in ſeveral places along the ſea-coaſt of the United States, heaps of putrefying fiſhes or their entrails along ſtreets and docks, where there were no growing plants to imbibe their remains, have emitted vapors of ſo unhealthy a quality as frequently to lay waſte the neighborhood by home-bred peſtilence.

Several diſſertations on the production of theſe aereal fluids, which according to circumſtances are either manures or poiſons, have been publiſhed, and are full of uſeful and valuable information on theſe parts of the ſubject. They have attracted an unuſual ſhare of attention as well in Europe as in this country. One of theſe has, at my ſuggeſtion, been tranſlated into the German tongue and publiſhed at Erlangen.

It is agreeable to find in the lateſt notices from Germany, that this ſyſtem of manures and peſtilence

is rapidly travelling through the univerſities of that great and learned country. The doctrine of ſepton in ſome places has been adopted to explain that important point of rural economics, the diſtempers of horned cattle and other domeſtic animals. My laſt letter from that quarter is full of ſuch information.

The *acid* nature of moſt animal manures and their exhalations, owing to a junction of the principle of putrefaction with a portion of oxygene, is of itſelf, a moſt intereſting diſcovery. But the inferences from ſuch a fact are of a ſtill more extenſive and beneficial kind, and by ſhewing the uſe and operation of *alkalies*, let us know how they are uſeful in combining with the acids inherent in the ſoil, and wafted through the air in a volatile form, and in both caſes have a ſweetening and neutralizing operation. Hence it may be inferred we are not far from poſſeſſing a true theory of lime, aſhes and calcarious earth, and of ſolving the problem which has puzzled inquirers ſo long, and which no European writer appears to have rightly underſtood. My correſpondence with Dr. Haworth, of Oxford, on this ſubject, will in due time be communicated to you. A vaſt induction of facts gives to this part of phyſics, lately ſo uncultivated and obſcure, an air wholly ſcientific.

About the time the enquiry into theſe matters had progreſſed thus far, Mr. Peters publiſhed his valuable eſſay upon gypſum and its uſes in the agriculture of Pennſylvania. The body of information collected into this performance, renders it a practical work of a very uſeful kind. It ſerved the more to contraſt the inland country, in its relation to plaiſter of Paris, with the tracts in the neighborhood of ſalt-water. On adding to my former collection of facts on the agricultural uſe of gypſum, the maſs of them exhibited in this work, I felt emboldened to make out a theory of its operation, as an appendix to Peter's performance. This paper is publiſhed in the firſt number of the Medical Repoſitory. The leading

idea is, that when gypſum does good, it is by virtue of its own decompoſition, and that this is commonly effected by the preſence of an alkali in the ſoil, which takes the ſulphuric acid away, and allows the ſeptic acid to combine with lime into calcarious nitre.

While theſe things were going on Dr. Prieſtley's pamphlet on phlogiſton came out, and was ſoon anſwered by citizen Adet, the ex-miniſter of the French Republic. On this very controverted point, a number of puzzling facts ſeemed difficult of reconcilement with the novel ſyſtem of the French. Theſe were ſelected and held up to the view of the philoſophical world to confute the antiphlogiſtians. In a converſation I had with Mr. Adet a ſhort time before his ſailing for Europe, he ſeemed confident of having given his antagoniſt a ſufficient anſwer. It appeared to me however on reviewing the whole controverſy that neither ſide was wholly right. I accordingly undertook a negociation between the contending chymiſts, and have forwarded the plan to London for the conſideration of the philoſophical world there. I have ſent alſo a copy of it to Dr. Prieſtley, and have received his anſwer. The main alteration here, conſiſts in expunging *hydrogene* from the nomenclature, and ſubſtituting *phlogiſton* in its ſtead. In doing this, I flatter myſelf, you will find, when the project ſhall be examined by you, that it contemplates a ſyſtem of reconcilement and harmony between the parties.

Some very coſtly and deciſive experiments on ſtreet manure, by members of this ſociety, ſhew at once their agricultural ſpirit, and the prodigious effects that a collection of ſubſtances is capable of working. The crops of Indian corn raiſed by Meſſrs. Stevens and Ludlow, will be long remembered by thoſe who are anxious to form a juſt eſtimate of the operation of manures.

On economical details, particularly as reſpects the ſaving of *food* and *fuel*, the eſſays of Count Rumford

ſurpaſs every thing of the kind that has come to my knowledge. His uncommon talents aided by uncommon opportunities have allowed him to deduce ſound principles from experiments conducted upon a vaſt ſcale. He has proceeded a great way towards reducing cookery from a ſervile art to a regular ſcience. All managers of public work-houſes, priſons, alms-houſes and hoſpitals, might make important ſaving by attending to the directions contained in this invaluable performance. A copy which I received from England, is at the ſervice of the members.

A bundle of papers read from time to time before the ſociety is now in my hands. Some of the ſubjects are intereſting, and the writers have treated them with ability. I ſubmit to your conſideration, the propriety of making them public, as well as the time and manner. It is a pity they ſhould have remained ſo long folded up in the ſecretary's deſk.

The models and machines which belong to you have not been diſperſed or loſt by reaſon of the temporary ſuſpenſion of your meetings. They have been moved from the place where the ſociety's meetings were formerly held in the city of New-York, to a place where they may be ſubſervient to the purpoſes of public inſtruction. They are now in the keeping of the profeſſor of mathematics in Columbia college.

The parcel of ſeeds, partly of ornamental and partly of uſeful plants, received from Mr. Thouin, the keeper of the national garden at Paris, has been diſtributed among the members; and it is for you to cauſe inquiry to be made concerning the ſucceſs of their cultivation.

A collection of plants in pots and boxes of earth, received from the ſociety of Cape Francois, re-aſſociated ſince the diſaſters which have ſo cruelly afflicted the iſland of St. Domingo, have been put into the hands of our preſident, for rearing and preſervation in his green-houſe. He will give you the neceſſary information of their thriftineſs or decline.

It may not be amiſs to mention to you that ſome young cinnamon and pepper trees have been received by a member of the ſociety.

It is to be regretted that the efforts of the ſociety to eſtabliſh a botanical and experimental farm, have hitherto been unſucceſsful. Your very narrow funds have been wholly inadequate to the purpoſe of eſtabliſhing ſo elegant and uſeful an inſtitution. While foreign ſovereigns vie with each other for obtaining the native productions of our land, and make appropriations of conſiderable ſums of money for the ſupport of botanical gardens; among us, the incurious or neglectful temper of our country paſſes them by as things of no moment.

But neceſſity will ere long compel a part at leaſt of our fellow-citizens to the cultivation of foreſt as well as of fruit trees. Axes and fire have already to a wide extent bared the land of its old and ſtately growth of wood. The increaſing price of fuel and timber is an alarming prelude of greater ſcarcity to come. The incloſing of wood-land, and the planting of trees, would be of unſpeakable advantage to the country, and tend mightily to the comfort of future generations.

Meteorological journals regularly kept in New-York, in Dutcheſs county, and in Albany, will, if continued with perſeverance, give you in proceſs of time, the data to form a correct judgment of the climate of our ſtate and country, with all the advantages to be derived from collections of ſuch facts as theſe regiſters are capable of affording.

Gentlemen of the Senate and Aſſembly,

By the act of incorporation the members of both houſes of the legiſlature are declared to be honorary members of the agricultural ſociety. Under legiſlative patronage has a large part of the inveſtigations, whoſe reſults have been laid before you, been ſupported and carried on.

If the exertions of the individuals who have toiled to promote the intereſts of practical ſcience and public utility, ſeem to you worthy of countenance, it is almoſt ſuperfluous to add that a ſmall addition to their funds, would enable them the better to proceed in their labors.

Gentlemen of the Legiſlature and of the Society,

When we contemplate the natural productions and advantages of our country, we muſt be deeply impreſſed with a ſenſe of the liberal proviſion which Divine Providence has afforded of the means of domeſtic reſource and independence. If we are wiſe, we ſhall appreciate the value and amount of the good things with which our land is thus bountifully ſupplied, and ſeek, what with well applied induſtry we ſhall be certain of finding, OUR TRUE HAPPINESS AT HOME; and under the protection of a free and repreſentative government, while we progreſs in manufactures and commerce, be forever mindful of the truth, that theſe, though the contrary has often been believed and taught, are not the *miſtreſſes*, but the HANDMAIDS of agriculture.

Experiments and Obſervations on the Culture of White Thorn for Hedges. By JONATHAN N. HAVENS, *Eſq.*

ALMOST every part of the territory of the United States was ſo completely covered with foreſt, when the inhabitants of Europe or their deſcendants, firſt began to make ſettlements in it, that timber was by far the cheapeſt and moſt convenient material that could be made uſe of for fences; but as the country has increaſed in population, almoſt every circumſtance has conſpired to diminiſh that quantity of wood which was reſerved when it was firſt ſettled: for as the people have multiplied, the

landed eſtates have been continually ſubdivided; and this has made it neceſſary to maintain a greater number of fences, and to conſume a greater quantity of fuel, and to erect and keep in repair a greater number of wooden buildings than were formerly neceſſary; and as eſtates have been ſubdivided, it has continually happened that individuals would have too much wood, although the neighborhood, town or place would have too little; and this has induced thoſe who were holders of the wood-land to cut off the greater part of it and ſell it, and improve the land in ſome other way. After the lands that had been tilled for ſome time, had become exhauſted, by continually ploughing more land than it was poſſible to manure, the temptation was exceeding great to clear a little new land to improve in the ſame way. And as the lands have become more ſubdivided, the difficulty of procuring a ſufficient maintenance from a ſmall quantity of land, has always induced individuals to ſell their wood, in order to ſupply their immediate wants. And the facility with which land in this country has always paſſed from one man to another by purchaſe, has contributed not a little to the deſtruction of wood; becauſe it would frequently happen that the purchaſers would have no other means of paying for the land, than by cutting off the wood and ſelling it. But what has contributed ſtill more to the deſtruction of wood in every part of the country which is near any navigable water, has been the great and increaſing demand for it in the cities of New-York and Philadelphia, and in many of the towns in their vicinity, where it has been wanted not only for fuel, but for burning bricks, and furniſhing other materials for building. And this increaſing demand will probably continue to diminiſh the quantity of wood in the country, until the price of it there, ſhall be equal to the price of it in theſe cities, or until it ſhall become cheaper to ſupply theſe large cities with coal; and as this cannot be done,

except at a great expence, and as an increaſe in the price of wood will always increaſe the inducement to ſell it, the proſpect ſeems to be, that the quantity of wood in the country muſt every where diminiſh with an accelerating velocity. It is true that this diminution of wood has cauſed ſome attention to be paid to its preſervation and growth; but generally ſpeaking, the ſame cauſes that have almoſt every where occaſioned its diminution, have been equally effectual to prevent its increaſe. The preference of an immediate private profit to a remote advantage of a more public nature, ſeems every where to have been the primary cauſe that has produced theſe effects. The inconveniences ariſing from the increaſing ſcarcity of every kind of wood ſuitable for fuel or for timber, have not been ſo ſeverely felt in thoſe parts of the country where recourſe could be conveniently had to ſtone to make wall, as has been the caſe in many parts of New-England; but in other parts, as common timber has grown ſcarce, the farmers have been reduced to the neceſſity of procuring cheſnut rails, at a great expence, which in many places has been much enhanced by the neceſſity of tranſporting them from diſtant places; and although this kind of timber will laſt a great length of time, yet the increaſing demand for it, combined with the other cauſes before mentioned, muſt neceſſarily make the quantity of it diminiſh as faſt as that of any other kind of wood; and the ſame thing may be obſerved with reſpect to any attempts that may have been made to introduce the uſe of cedar, or any other kind of laſting wood. Theſe general obſervations reſpecting the increaſing ſcarcity of wood, might naturally lead us to a conſideration of the moſt effectual means to preſerve it, and to promote its growth; but they have been now brought into view, principally with an intent to ſhew, that it muſt be a matter of the greateſt importance to the agricultural intereſt of the country, to turn its attention as ſpeedily as poſſible to the

cultivation of all thoſe kinds of trees, or ſhrubs, which have been generally eſteemed moſt ſuitable for a hedge. There is no doubt but that almoſt every kind of tree might be made to anſwer, in a greater or leſs degree, the purpoſe of making a hedge, were it not that in the winter time and in the ſpring of the year, when the twigs firſt ſhoot out and are tender, they are liable to be bitten and deſtroyed by cattle; the qualities therefore, moſt eſſentially neceſſary in a tree to make it valuable for a hedge, appear to be, either that it ſhould be well defended by ſome kind of thorns, or of a taſte diſagreeable to cattle. There are beſides theſe, other qualities of nearly equal importance; ſuch as that it ſhould be of a durable nature; of a quick growth; not apt to be injured by inſects; eaſily propagated; not difficult to grow on account of the qualities and ſtrength of the ſoil; and inclining naturally to grow like a buſh, or to grow well after it has been cut off or lopped. It is improbable that we ſhall ever find any kind of tree that has all theſe qualities, we ought, therefore, to make choice of thoſe which have the moſt important of them; and among all the various kinds of trees which have been uſed or thought of for a hedge, I believe none has been more generally approved of than the white thorn, or hawthorn, as it has been uſually termed by the writers on agriculture. There are three ſpecies of the white thorn growing in this country; two of theſe are natives of the country, and the other has been imported, as I believe, from Great Britain, and is the ſort which has always been ſo much approved of there for making the beſt kind of hedge; and excepting theſe three, I have not ſeen any other ſpecies of this thorn growing in any part of the country. Theſe three ſorts of thorn may be very eaſily diſtinguiſhed from each other by their leaves; the Britiſh has a ſmall leaf which is very much indented; and the leaves of the other two ſorts are very little indented, but the one

has a much larger and broader leaf than the other: theſe two latter ſorts I ſhall now diſtinguiſh by the names of the *broad-leaved* and the *narrow-leaved* white thorn. The Britiſh bears a ſmall haw with only a ſingle ſeed in it, and its thorns are ſhorter and not ſo viſible as thoſe of the other two ſorts, they being more covered with the leaves, and, as I think, not ſo many in number, as thoſe on the narrow leaved ſort; and when not prevented by being cut or pruned, or by being crowded in a hedge, or by other trees, it will aſſume the ſhape of a ſmall pear tree; and in a good ſoil will grow until it is about eighteen or twenty feet high. The broad-leaved ſort bears a larger haw than either of the others, with four ſeeds in it, generally, but ſometimes with only three, and in a few inſtances with not more than two; its thorns are longer and more eaſily ſeen than the Britiſh, but, I think, not more numerous; and in a good ſoil, with other circumſtances equally favorable, it will grow much larger and higher than either of the other two ſorts. The narrow-leaved ſort bears a ſmall haw like the Britiſh, with only a ſingle ſeed in it; its thorns are numerous, long, black and very conſpicuous; it ſeems naturally inclined to grow more like a buſh than either of the others, and its branches are frequently large in proportion to its ſize, and grow out horizontally not far from the ground.

It is difficult to pronounce with certainty, concerning the comparative merits of theſe three ſpecies of thorn, when uſed for the purpoſe of making hedges, becauſe ſo little has been as yet learned concerning their growth and culture by experience; but from every appearance, I think the narrow-leaved white thorn ought to be conſidered as ſuperior to either of the others, when applied for that purpoſe; its natural growth ſeems to be more favorable, and its numerous long black thorns appear to render it leſs liable to be injured by cattle when

it is young ; and I preſume that under the ſame circumſtances its growth will be as quick as either of the other ſorts ; but at the ſame time there can be no doubt, but that the other ſorts, when properly attended to, will very well anſwer the purpoſe. I believe that more frequent attempts would have been heretofore made to plant hedges of the American white thorn, had it not been very ſcarce, and difficult to be procured in ſuch numbers as to make it worth while to ſet them out for a hedge : the only method of procuring them has been to tranſplant thoſe which are growing wild in the fields or woods, and which are generally very few in number, and a great proportion of theſe too large or too old, or otherwiſe unfit to be removed. It does not appear that the white thorn will ever grow from the ſlips, and the grand difficulty, with reſpect to the ſpeedy propagation of theſe two ſpecies of it which are natives of this country, has heretofore conſiſted in making the ſeeds come up ; for after they have once ſprouted, it does not appear that there is any peculiar difficulty in their growth, more than in that of other trees. Repeated attempts have in times paſt been made in various parts of the country, to make the ſeeds come up, by planting them in various manners, but without ſucceſs ; and as the tree does not appear to come up of itſelf in its natural ſtate, except when the haw has been eaten by a bird, or ſome other animal, and afterwards dropt in their dung, an opinion has prevailed that they never would come up, unleſs they firſt underwent ſome peculiar kind of fermentation, or were operated upon in ſome peculiar manner, by paſſing through the body of a bird, or ſome other animal ; and in purſuance of this idea, attempts have been made to make them come up by giving the haws to horſes with their oats, and afterwards planting the ſeeds which would be in their dung ; but theſe attempts have not proved ſucceſsful. From theſe unſucceſs-

ful experiments it was naturally inferred, that perhaps there was a difference in animals in that reſpect, and that it might be neceſſary for the ſeed to paſs through the body of a bird, before it would ſprout. When once the opinion came, by theſe means to be eſtabliſhed, that it was neceſſary for the ſeed to paſs through the body of ſome animal before it would ſprout, and that very probably there was a difference in animals in that reſpect, it ſeemed to preclude all further inquiry on the ſubject. But notwithſtanding theſe unſucceſsful attempts, the opinion always appeared to me very improbable, that nature had provided no other method than this for the propagation of the American white thorn; when it appeared, as well from writers on agriculture, as from the information of perſons who had reſided in England, and who were well informed on the ſubject, that there was no peculiar or remarkable difficulty in cultivating the Britiſh white thorn in that country; and that it was only neceſſary to gather the haws as ſoon as they became ripe in the fall of the year, and bury them in the ground below the froſt, and let them remain there until the ſecond ſpring after they were buried, and then take them and plant them in a nurſery, to be prepared for that purpoſe, and they would come up without any difficulty: and I was alſo fully perſuaded that this prevailing opinion muſt be ill founded, from a conſideration of the deſcriptions that are given of the white thorn by botanical writers, who repreſent it as a kind of tree whoſe ſeed will not come up until the ſecond year after it is planted. I was therefore induced, as well from motives of curioſity, as from a conſideration of the great importance of introducing the cultivation of the white thorn for hedges, to enter in a courſe of experiments relative to this ſubject; and to engage ſome others to make experiments of a ſimilar nature; in order, if poſſible, to aſcertain whether the native white thorn of America might not be cultivated with

more facility, than had been heretofore imagined; and whether the Britiſh white thorn would not grow in this country with as little difficulty as it does in England. The reſult of theſe I ſhall now communicate to the ſociety.

No. 1.

In April, 1792, I gathered, from both the ſorts of the American white thorn before deſcribed, a number of haws which had lain on the ground under the trees, expoſed to the froſt during the preceding winter, and cracked the ſeeds contained in them with great care, ſo as not to injure the meat or chit that is contained in the ſhell of the ſeed, and planted theſe chits in the richeſt garden mould that could be procured, mixed with cow dung. None of theſe ever came up in that ſummer or the ſummer after. It appeared from repeated examination, that they were not injured by any kind of inſect, or prevented from growing by any extraneous circumſtance. I cracked the ſeed becauſe the ſhell is ſo extremely hard, and has ſo little appearance of a ſeam, or place of ſeparation, that it appears almoſt impoſſible for the chit to open it; and I thought that this probably might be the reaſon why it had always been ſo difficult a matter to make it ſprout. In cracking the ſeeds I remarked that a conſiderable proportion of thoſe of the broad-leaved ſort were ſolid; that is, deſtitute of any chit, and therefore could not be expected ever to come up. From this experiment, and from the general obſervation that the haws that fall from the tree ſeldom or ever come up round it, or near it, I inferred, that the ſeed would never grow after it had been expoſed for any length of time to the froſt; and this inference appeared the more probable from a conſideration of the manner in which it had always been ſuppoſed neceſſary to manage, with reſpect to the Britiſh white thorn; and yet it ſeemed difficult to aſſign any ſatisfactory reaſon why the

ſeed which grows naturally in the field, and is ſuppoſed to be carried by birds, ſhould not ſuffer the ſame injury by long expoſure to the froſt and bad weather, as the ſeed which falls from the tree ; unleſs the opinion were to be admitted, that, in paſſing through the body of the bird, the ſeed was operated upon in ſuch a manner as to prevent it.

No. 2.

In my next experiment I determined to imitate nature as nearly as poſſible, conſiſtent with the caution that appeared to be neceſſary in guarding the ſeed againſt the bad effects of a long expoſure to froſt and bad weather; and therefore, in the fall of the year 1792, before there had been any froſt, I gathered about four quarts of haws, one half of which were of the broad-leaved, and the other of the narrow-leaved white thorn, and planted them in the following manner : having prepared a ſmall bed in my garden, by boarding it at the ſides to prevent weeds and graſs from ſpreading into it, and with a partition board acroſs the middle of it, I laid the two ſorts of haws ſeparately in each diviſion of the bed, about an inch from each other, and then put over them a layer of hen dung about an inch thick, and over this a layer of fine garden mould of nearly the ſame thickneſs. They continued in this ſtate until the next ſpring : I then took them up and examined them, and found that they had no appearance of growing in that ſeaſon, and fearing that the ſtrength of the hen dung might be too much waſhed away from them to be of any advantage in making them ſprout in the enſuing year, I laid them down with a freſh layer of hen dung and fine earth, in the ſame manner as before. They remained in this ſtate until the ſpring enſuing, which was in the year 1794, and then about a quarter part of the ſound ſeeds, as nearly as I could eſtimate, came up and grew very well. They were evidently planted too thick, and as I thought, too deep, other-

wiſe I am inclined to believe, that a greater proportion of them would have come up and grown. By the fall of that year, they were generally about ſix or eight inches high, and I thought it would be beſt to let them remain in the bed until another year. In the fall of the year 1795, the greater part of them had grown to be more than a foot, and many more than eighteen inches high; and I then ſet them in a nurſery in rows two feet apart, and at the diſtance of eighteen inches from each other; and they are now* more than two feet and many of them more than three feet high. From this experiment it appeared that the opinion was erroneous which had been before entertained, that it was neceſſary for the ſeeds to paſs through the body of a bird or ſome other animal before they would grow; and that a ſufficient number of them might be made to come up every ſpring, after the ſecond year, by planting them in the fall of every year, after the manner which had been purſued in this experiment; for if no greater proportion than one quarter, or one-fifth of the ſeed planted, ſhould ever come up, it would be no ſerious objection againſt the cultivation of the thorn, becauſe the tree ſeldom fails to produce haws in ſo great a plenty as to make it no difficult matter to procure any quantity that may be neceſſary.

No. 3.

At the ſame time that I began the laſt experiment in the fall of the year 1792, a gentleman in my neighbourhood began a ſimilar experiment upon the Britiſh white thorn, in order to aſcertain whether it would not grow when managed after the Engliſh manner. He gathered about half a buſhel of the haws in the fall of the year, before they could be injured by the froſt, and put a part of them into a box,

* In Auguſt, 1796.

and placed it in a hole dug in the ground for that purpoſe, which was ſufficiently deep for the box to be out of the way of the froſt when the hole was properly covered. The remaining part he put into the ſame hole on the out-ſide of the box, and then put a board and a heap of earth over the hole in the ſame manner as potatoes are uſually buried. They appeared, when examined in the ſummer following, to have undergone no viſible alteration; and in the ſpring following, which was in the year 1794, they were not thought of until ſome time in April, and were then examined, and thoſe which had lain out-ſide of the box, and were of conſequence moſt expoſed to the wet, had already grown too much to be of any uſe; and many of thoſe which were in the box had begun to ſprout. They were then taken up and planted in rows that were about a foot apart, and great numbers of them came up, and have ſince grown as well as thoſe which had been planted in hen dung, as mentioned in the laſt experiment. From this experiment it was ſufficiently evident that the Britiſh white thorn might be propagated in this country without any very great trouble or difficulty, and probably with as much eaſe as it is in England. Whether it will grow as well and be as durable as the native white thorn of the country, after it has been ſet out in a hedge, can only be determined by a full and fair experiment, to be made upon all the different ſorts of thorn that have been mentioned.

No. 4.

In the fall of the year 1794, the ſame gentleman began to make an experiment upon the native white thorn of the country, and gathered a quantity of haws from the broad-leaved ſort of white thorn before deſcribed, and buried them in the ground below the froſt, but without putting them into a box, as he had done before with reſpect to the Britiſh; and laſt ſpring they were taken up and planted, but only a

very few have come up. At the ſame time that he firſt buried theſe, he alſo began a ſecond experiment upon the haws of the Britiſh, and found that by keeping them in the ground until the ſpring of the ſecond year, they would come up as before.

No. 5.

December 1, 1794. I gathered about three pecks of the haws of the narrow-leaved white thorn, and put them into a box which had a partition in the middle; the one part I filled with a layer of the haws and a thin layer of hen dung alternately, and the other with alternate layers of the ſame ſort of haws and horſe dung. The box was then ſet in a hole dug in the ground for that purpoſe, and which was deep enough for the top of the box to be nearly a foot below the ſurface. On the out-ſide of the box, at one end, I put about three quarts of the ſame ſort of haws, and at the other, nearly the ſame quantity of the broad-leaved ſort, without any dung applied to either. The box was then covered with pieces of boards, and a heap of earth thrown over the hole, after the manner in which potatoes are commonly covered. They were not examined until the ſummer following, and then they appeared not to have undergone any perceivable alteration; and thoſe which were in the box appeared to be in a ſituation which would prevent them from being ſufficiently ſoaked by the moiſture of the earth. They were then covered again as before, and remained in that ſtate until the laſt ſpring, and then they were all taken up, and planted ſeparately in a bed prepared for that purpoſe. Only a very few of theſe have come up this ſummer, perhaps not many more than one in five hundred of the whole number of ſeeds that were planted.

Notwithſtanding the ill ſucceſs of theſe two laſt experiments, I do not think that the idea of raiſing the American white thorn by burying the haws in

the earth until the ſpring of the ſecond year, ought to be given up as altogether impracticable. The haws in this latter experiment were evidently kept too dry, and the bed in which they were planted is a dry light ſoil, and has been much affected by the dryneſs of the preſent ſeaſon; and in the former they might probably have been affected in the ſame manner. If I ſhould make any further experiments on this ſubject, it is my intention to try what would be the effect of placing the haws in a very wet ſituation, or where they would be frequently ſoaked with rain water. The ſhell of the ſeed is ſo extremely hard, that I am inclined to ſuſpect that a great proportion of wet, with a more moderate degree of heat, would be more likely to make them ſprout than a greater degree of heat in a ſituation that is more dry; but it is experience alone that can determine this matter with any degree of certainty. But if this method of managing them ſhould altogether fail, it would be no material objection againſt raiſing theſe two ſorts of thorn, provided that the method pointed out in experiment No. 2, ſhould generally prove ſucceſsful. Several perſons within the ſphere of my acquaintance, as I have been informed, after hearing of the ſucceſs of the experiments No. 2, and 3, began to make ſimilar experiments upon the American white thorn, by burying the haws in the ground, after the Engliſh manner; and it was my intention to have communicated the reſult of theſe to the ſociety, but I have not been ſufficiently informed of the particulars concerning them to communicate any thing at preſent.

I cannot conclude theſe obſervations without making ſome reply to the moſt material objections that are uſually brought againſt the cultivation of the white thorn for a hedge, independent of the difficulty of making the ſeed grow. 1. It is ſaid that it is a tree of very ſlow growth; that therefore it muſt be a very long time before a hedge of it will grow large

enough to defend itſelf, and to be of any uſe; that in the mean time it muſt require a great deal of time and attention to take care of it, as well as a very expenſive rail fence to be erected on each ſide of it, to prevent it from being deſtroyed by cattle. It is true that it is a tree of not very quick growth; but I am pretty well perſuaded that under ſimilar circumſtances it will grow as faſt as an apple-tree; that is, it will grow to its uſual ſize in the ſame time that an apple-tree will attain to its full growth, ſuppoſing each to be planted in a ſoil equally favorable, and to have a ſimilar attention paid to it. But it is found advantageous to cultivate apple-trees as well as many other ſorts of trees which may require a longer time to grow large enough to be valuable, notwithſtanding the profits that are to reſult may be diſtant, and why may not this be the caſe with reſpect to thorn? and beſides this, if the objection were admitted to be valid, it muſt operate for ever againſt the cultivation of this or any other kind of living hedge which would require any conſiderable length of time to grow large enough to be valuable. And with reſpect to the expence of guarding it when it is young, the difficulty might be in a great meaſure obviated, by fencing it only on one ſide, or ſetting it by a fence that muſt be kept in repair, and depending upon a good ditch to defend it on the other ſide; and by making uſe of the cheapeſt materials for the fence, ſuch as poles, or bruſh, or the like. But admitting that the expence of defending it with a wooden fence ſhould be very conſiderable, it only proves that the cultivation of the white thorn ought to be introduced as ſoon as poſſible, before the preſent fences that are now ſtanding have all decayed, and the wood that is now in the country is all gone, or become too ſcarce to be procured. It is true that if any other tree or ſhrub could be found, whoſe growth would be more quick than the white thorn, and which in other reſpects would anſwer equally well, it ought to be pre-

fered; but no ſuch tree or ſhrub hath been yet found. The prim did ſome years ago promiſe ſomething of the kind; but this has been long ſince dead, and there appears no probability that it will ever flouriſh again. The black thorn has been deſtroyed by a worm that preys upon its twigs, and is, beſides this, much inclined to ſpread into the land. The locuſt is ſoon broken through and devoured by cattle, and in many places is deſtroyed by a worm: on the contrary, the white thorn is never very materially injured by any kind of inſect, is effectually protected from the attacks of every kind of larger animal by its thorns, and promiſes fully to compenſate for the flowneſs of its growth, and the trouble of raiſing it, by its greater durability. And it may be remarked generally, that thoſe kinds of trees or ſhrubs, which would be thought ſuitable for a hedge, and which are of a quick growth, are either leſs durable in proportion, or will be attended with ſome other inconvenience which will overbalance that advantage. 2. It is objected that the white thorn tree will not grow except on ſome particular kinds of ſoil, and that it requires very rich land. There is no doubt but that white thorn, like all other trees, will flouriſh beſt in a rich light ſoil, that is not apt to be hard bound. It is the tough, hard ſward that ſpreads itſelf over the ſurface of the ground that is moſt detrimental to the growth of trees. All kinds of trees will derive nearly as much benefit from being hoed, or having the ground kept looſe around them, as Indian corn. So that this objection ſeems rather to be a general one, againſt the cultivation of all kinds of living hedges, than any thing particularly applicable to white thorn. The weight of it, beſides this, is leſſened by the conſideration that hedges will naturally make the land grow richer around them by collecting ſnow and other matters of a fertilizing nature; but admitting the weight of the objection in its fulleſt force, there is ſtill little room to doubt but that with proper pains and atten-

tion it would grow very well on ſo large a proportion of the ſoil of this country, as muſt make it well worth the attention of farmers to attempt its cultivation. 3. It is objected that the white thorn hedge grows very thin, and as it never ſpreads from the root, nor do any of the haws ever come up in the hedge, it muſt grow thinner as it grows older, and ſoon become of little uſe. It is true that the greater part of the white thorn hedges that have been heretofore ſet out, have now become too thin and open in many places; but one principal reaſon why they have become ſo, has been, becauſe they were originally ſet out too thin; the great ſcarcity of the thorn tree made it neceſſary to ſet them in that manner, and afterwards to depend upon lopping the trees to thicken the hedge; but if a ſufficient number can be procured by raiſing them in nurſeries, then a different practice may be adopted, and they may be ſet as near to each other as ſhall be found by experience to to be moſt advantageous; and the tops of the trees may be cut entirely off inſtead of being lopped, which will make them grow more thick and buſhy; and this is the manner in which they ought ever to be managed. But if the edge ſhould, notwithſtanding, be too thin in many places, it is ſaid that the eglantine, or ſweet-brier, or wild roſe, as it is commonly called, may be uſed to great advantage to fill up ſuch vacancies; and it is alſo ſaid, that it would anſwer a moſt valuable purpoſe to ſet it out in the hedge along with the young thorn; that it would help to thicken the hedge, and would ſerve to protect the thorn whilſt it was growing, and would therefore help to leſſen the expence of defending it by a dead fence. The eglantine is ſaid alſo to have theſe advantages, that it will grow on a ſoil that is light and thin, and that it may be eaſily propagated from the ſeed, which will come up and grow after the ſecond year like the ſeed of the white thorn. 4. It is ſaid by way of objection, that it would be

more advantageous to raiſe the cheſnut-tree for rails, than to raiſe thorn; and that the wood is of ſo durable a nature, that a cheſnut rail will grow before another of the ſame ſize will decay. I believe there is no doubt but that a new cheſnut rail put into a fence, will laſt until another of the ſame ſize will grow, but notwithſtanding this, we do not find people more engaged in raiſing cheſnut than in raiſing any other kind of timber, and it muſt be becauſe the ſame difficulties occur in the one caſe as in the other; a quantity of land muſt be ſet apart for that purpoſe, and muſt be fenced for a great number of years before any profit can be derived from it; and people will generally prefer the immediate profits which they can derive from their lands by cultivating them annually, to a much greater profit which is not to be received until after a conſiderable length of time. Thorn muſt therefore have this advantage over cheſnut, that it will occupy much leſs ground when growing in a nurſery, than a grove of cheſnut-trees that would make a fence of the ſame length; and when grown into a hedge would defend the land much better againſt the ſeverity of the winter. I have now conſidered the moſt material objections that I have ever heard againſt the introduction of the white thorn for hedges, and it was my intention to have ſubjoined ſome remarks on the advantages of cultivating ſeveral other kinds of trees for the ſame purpoſe, and particularly the button-wood, or ball-tree, as it is called by many, but I have found that this would lead me into a diſcuſſion of too great length. I am fully ſenſible that on a ſubject of this nature, much is to be learned from experience, and that many projects for improvement, which promiſe very fair at firſt, will not, upon trial, prove ſo advantageous as was expected; but this conſideration ought not to deter us from making any attempt where there may be a reaſonable proſpect of ſucceſs; and more eſpecially if the advantages that are to reſult are great, if it ſhould prove ſucceſsful.

Observations *on* Manures.

By Ezra L'Hommedieu, *Eſquire.*

Read in March, 1795.

SOME time ago I communicated to the ſociety a few experiments which had been made with fiſh manure on the ſea-coaſts. This ſource of manure is now become very conſiderable, and anſwers every purpoſe which was expected. New methods are now uſed as well for taking the fiſh, as for preparing the land by this manure: very long ſeines are made uſe of, and it is not uncommon to ſee twenty ox-cart loads of the menhaden or moſbankers taken at one draught. When the ends of the ſeine are drawn to the ſhore and the fiſh crowded cloſe together, an ox-cart is drove into the water amongſt the fiſh, and two or three hands with ſcoop-nets, ſoon load the cart, which is drove off, and another is drove in and filled in like manner, and ſo one after another, until the whole is carried away. Inſtead of making a compoſt with thoſe fiſh, it is now very common, and prefered by many, to cart the fiſh directly to the field you propoſe to ſow with wheat, where, as the cart is drove along, two or three hands are continually throwing out the fiſh on the ground, ſo that the whole may be covered with fiſh at about eighteen inches aſunder; theſe fiſh ſoon diſſolve, the ground is plough-ed, well harrowed, and ſowed early with wheat, and produces a good crop although the land be poor. It is eaſily perceived how much labour is ſaved by this practice: in making a compoſt the fiſh muſt be cart-ed to a heap, and four loads of dirt at leaſt uſed to one of fiſh; when the heap or compoſt is made, it muſt be carted again at ſowing time, laid in heaps and then ſpread on the ground. There can be no doubt but a conſiderable loſs is ſuſtained by the effluvia from the fiſh when they are ſo ſpread on the ground; but this loſs is ſuppoſed not ſo great as the expence of making the compoſt and the ſecond carting. Anoth-

er objection to the compoſt is, that it is with great difficulty you can make your heap of compoſt ſo as to be equally impregnated with the putrefaction of the fiſh; and the manure is ſo ſtrong that it is difficult to ſpread it even, in a ſufficient quantity to the quality of the land. Laſt year although the wheat was ſown very late, many farmers in the ſpring were obliged to mow their fields of wheat, where they had uſed this compoſt, to ſave the crop. I ſpread this compoſt on a piece of land which was ploughed and planted with Indian corn, and on the twenty-fourth day of October, in the ſame year, I ſowed the ſame land with wheat; and although the crop of corn was large, the wheat grew too high and lodged, which hurt the crop conſiderably. I ſhould not have ſowed this wheat till about the tenth of November, were it not for the inſect commonly called the Heſſian fly, I ſhould not adviſe to the manuring of poor land very high, at one time, for a crop of wheat, which if made very large by any manure, will be ſubject to many caſualties which ſmaller wheat will not be liable to; and taking one ſeaſon with another, I believe it will not be profitable to manure poor land at one time, higher than to produce twenty buſhels to the acre; the crops will be more ſure at about ſixteen buſhels: much wheat has been loſt by the practice of manuring poor lands too high at one time.

In many parts of the country which have been long improved, and exhauſted, or made poor by cropping, there appears to be as great an emulation amongſt farmers in procuring manure, as we obſerve among farmers in a new country in clearing their lands. He that pays the greateſt attention to manure in the former caſe, as he who ſubdues or clears the moſt land in the latter, is called the beſt farmer: but the greateſt difficulty is to procure a ſufficient quantity of manure for the annual conſumption neceſſary for the improvement of our old worn out

farms. The manure made by the ſtock of cattle on ſuch farms is very inadequate to their neceſſities; therefore it is of great importance that we reſort to new reſources for manuring our poor lands.

I have lately ſeen the practice of digging a hole behind the kitchens of farm houſes at the diſtance of twenty or thirty feet, and of the bigneſs of about fifteen or ſeventeen feet in diameter, and about three feet deep in the middle; this hole is filled with turf or dirt from the ſtreet or ſome hollow (the richer the turf or dirt the better) and from the ſink in the kitchen, all the dirty and diſh water runs into this hole, all the ſoap-ſuds or waters in which cloaths have been waſhed is conveyed to this hole, all the dirty aſhes, lime, chamber-lye, or any thing from the houſe which has a tendency to make manure are thrown on this dirt; in ſhort it is a common receptacle for all dirt and filth of the houſe. In the fall of the year the contents of this hole are carted away, and uſed for manure in raiſing of wheat. The hole is immediately filled up again with turf or dirt, to be prepared for another year: ſome farmers make twenty tons of this manure in one year, which is more than is made by a ſmall ſtock of cattle.

During the late war great encouragement was given for making ſaltpetre; the dirt taken from under houſes and barns was uſed for this purpoſe, and was found to be a good manure even after it had been leached, if laid in a heap under cover for ſome time. Upon this principle a practice has been adopted by many farmers of taking all the looſe dirt from under their ſtables, cow-houſes and barns at the ſeaſon of the year when their barns are empty, and carting new earth to ſupply the place, which by being kept under cover will be impregnated with nitre and become good manure. In ſtables or under the floors of ſtables, by the addition of the urine from the horſes and their dung, where there are no floors, this earth may be removed in this manner, every

year to advantage for manure, and will be another conſiderable addition to the quantity which is wanted.

I find that peat is coming into uſe as a manure; it has long been uſed in England for that purpoſe: I have had ſome experience of it myſelf, and find it anſwers very well. It is to be found in moſt ſwamps which are not ſubject to ſprings, and may be known by its cutting ſmooth not unlike to butter or hog's fat in cold weather. It is generally found within twelve or eighteen inches from the ſurface, and may be eaſily known by drying it in the ſun, when it will burn; it is now uſed for fewel in ſome parts of our country where wood is ſcarce and dear. It is of different colours, but that of the brown is the beſt, becauſe it makes the moſt aſhes. The beſt way of making it profitable for manure is to dig it up with ſpades and cart it on the land propoſed to be manured, where it is laid in long heaps in different parts of the field, and when dry, with ſome bruſh or refuſe wood is ſet on fire: it will burn ſlowly and make much aſhes, and will not readily go out by rain; if it is more convenient it may be thrown or caſt on the land when it is dug up, and there burnt into aſhes, which will ſave much expenſe in carting. Thoſe aſhes are uſed in the ſame manner as wood aſhes, and are preferable. Where ſwamps have taken fire by accident, I have ſeen great quantities of thoſe aſhes made from the peat, which were uſed to good purpoſe as a manure; but I would not recommend ſetting fire to a ſwamp for procuring thoſe aſhes, as a valuable piece of ground may by this means be deſtroyed. I have lately ſeen ſlack burnt broken bricks carted from a brickkiln and ſpread on poor land, the owner of which informed me that this burnt clay was a good manure eſpecially for light land. What is called *clay aſhes* is uſed in many parts of England and is highly eſteemed as a manure. In many parts of our country I believe it

will be the cheapeſt manure that can be procured. I have not heard of any experiments being made with it here, except the one I have mentioned.

I mean to try it this year, and that others may make experiments of the ſame, I ſhall give a receipt which I have lately ſeen, for burning the clay. "Dig your clay with a ſpade in ſpits of ordinary bricks; dig two, three, eight, ten or twenty loads of clay, more or leſs as you pleaſe; take ſmall billets of wood or faggots of bruſh, pile it up in the form of a pyramid or ſugar loaf, three or four feet high, then take theſe ſpits of clay, after they are dried in the ſun, ſurround your pile of wood with them, laying them cloſe on the wood, and laying them one upon another till you have encloſed the pile of wood, only leaving a hole on the ſide to put in the fire, and an hole on the top to make a draught; then ſurround again with ſpits of clay from top to bottom as before, and then a third laying in the ſame order, then kindle the fire: when it is well gotten on fire, ſtop up the holes with clay, the innate heat will fire the clay till it grows ſo hot that you may put on wet clay in great quantities; but you muſt mind not to put on clay ſo faſt, or clay it ſo cloſe as to put out your fire, for if you do, you muſt begin all anew: if you deſire to burn ſo much clay as that the heap grows ſo high that you cannot reach to lay it up, you may build a ſtage with boards, by which you may advance to as great a height as you pleaſe. The pile muſt be watched day and night till it is fully burnt."

The difficulty of procuring manure in ſufficient quantities, ought to learn the farmer to uſe it in the moſt economical manner; much of his manure may be ſaved by good tilling. Ground well tilled will not take half the manure for a crop as ground of the ſame quality prepared in the uſual way. I knew a farmer in Suffolk county who had always better crops of flax than his neighbors, upon lands not ſuperior to

theirs, being aſked the reaſon, he anſwered, it was becauſe he always harrowed his ground three times over, after it was harrowed enough. As I mentioned harrowing I will make an obſervation which may be of uſe, which is, that the faſter your harrow goes over the ground, the better, a quick ſtroke againſt the clogs breaks them much eaſier than a ſlow motion; harrowing with horſes is to be preferred to harrowing with oxen, becauſe they move quicker: with a light harrow the horſes may go on a trot, which will break the clods much finer than when they go on a walk. This I have ſeen done to good purpoſe. There can be no doubt but pulveriſing the earth in moſt ſoils anſwers the purpoſe of manure in a conſiderable degree. Mr. Tull who was an ingenious writer on huſbandry, carried his theory ſo far as to ſuppoſe that the diviſion of earth by tillage would anſwer every purpoſe of manure, and that dung only ſeparates the parts of the earth, and that it is immaterial whether this is done by the plough or other inſtrument of huſbandry, or by dung. This philoſophy ſuppoſes that dung or any other manure only divides the earth, and ſets the parts at a ſuitable diſtance, to give free paſſage to the roots of plants, and in this action the ſalts in dung hath much the ſame operation and effect as emptyings hath on dough, it makes it riſe, that is, it ſets the parts at a diſtance, and it is immaterial how this is produced, the effect is the ſame. Although I cannot ſubſcribe to this theory, and am not ſatisfied of the principles of vegetation, yet we can make no doubt but good tillage is very eſſential, and ſaves much labour as well as expence in raiſing a crop. The finer the parts of the earth are made, the better, this we conſtantly experience in our gardens, and the ſame advantage would take place in our fields. The dews abſorbed by the earth, when made fine or pulveriſed, and the nitre which adheres to it, add greatly to vegetation. It is found that the fine duſt in the ſtreets, in a dry time, is

ſo impregnated with nitre, that it will make ſalt petre; and a farmer's time in a dry ſeaſon, would be well employed in collecting this fine duſt and putting it under cover till he ſhould want it to put on his wheat ground. Too much attention cannot be given to prepare a field for a crop; the finer the earth is made, (a good depth) the more dews and ſalts it will receive and retain. It is well known to farmers, that the beſt tilled lands, or thoſe lands where the parts are made the fineſt, bear the drought much better than lands poorly tilled; and the beſt ploughed and hoed Indian corn, always bears the drought beſt: the reaſon is evident, it is beſt prepared to receive and retain the dews and ſalts of the atmoſphere, which enrich the land as well as promote vegetation. An experiment has been made to aſcertain the difference between dew-water and rain-water, by putting an equal quantity in different veſſels, and ſetting them in the ſun to dry away; the reſult was, that the ſediments or ſettlings of the dew-water were more in quantity, blacker, and richer than that of the rain-water. Some lands we find are too open and looſe; the parts are too far ſeparated for much vegetation, this may be occaſioned by continual manuring and pulveriſing; on Connecticut river, I ſaw a farmer yarding his cattle early in the ſpring, in his onion garden, and aſked him for what purpoſe they were put in: he anſwered to tread the land, and that the garden would not produce well after a number of years, unleſs it was trod; but the reaſon of it he did not know. I ſhall only mention at preſent one more reſource for manure, which I have ſeen practiſed to great advantage. In the ſpring plough up a piece of ground proportionally large to the number of cows and other cattle you propoſe to yard during the ſummer: let it be long and narrow for the conveniency of ploughing, this being fenced, yard your cattle in it for two or three weeks, then plough up the whole again, and continue this prac-

tice till the time of ſowing wheat; then cart away all the dirt as deep as was ploughed on your wheat field, and ſpread and harrow it in with the wheat: by this means you get ten times more profit than you can make by yarding your cattle in the cow-yard, or on unploughed ground. This ploughed-ground, being made mellow, abſorbs the ſtale and dung of the cattle; it receives and retains the dews and ſalts of the atmoſphere, and becomes good manure for wheat: thus a farmer by the help of this dirt, ſo improved, with the dirt which he may take from his ſtables, cow-houſes, and other buildings, with what he may make from his dung-hole, which I have deſcribed, in addition to what is made by his cattle and horſes in the winter, will be enabled to add greatly to the improvement and productions of his farm, although his ſituation will not admit of his being benefitted by peat or clay aſhes or other manures which I have heretofore mentioned, and cannot be obtained to advantage, except by thoſe who live near the ſea coaſts, ſuch as fiſh manure, ſea weed, Indian ſhells, creek mud, &c.

The city of New-York affords great quantities of manure from aſhes, ſtreet dirt, ſtable dung, and earth taken from under old buildings; theſe different kinds of manure are in great demand, and conſequently have become very dear. They will however be purchaſed to advantage by thoſe who can attend the market, and others who can tranſport them by water at no great diſtance from the city. Laſt fall I ſaw in Queens county (about eight miles from the city) in a farmer's yard, a large pile of manure, and found that it was brought from New-York, that his manure coſt him laſt year two hundred pounds, and that he had not much above one hundred acres of land; and without this manure he could make but little profit of his farm. This is uſing an active capital in the improvement of land, and adding to ones' real eſtate by laying out part of

the money which is made from the produce every year to better purpoſe than putting it on loan or purchaſing poor land.

It is worth knowing, that fruit trees, manured with fiſh, are brought forward much faſter than thoſe which have the advantage of vegetable manure. It is ſaid that the growth of a young tree manured with fiſh, will in one ſeaſon be nearly double to one manured with yard dung. The experiments have chiefly been made on young apple-trees, and it is ſurpriſing to ſee the difference between animal and vegetable manure, or the manure made by the putrefaction of animals, and that made by the putrefaction of vegetables. I hope this may encourage the raiſing of orchards, which is too much neglected, and will be a comfortable hearing to farmers who live in parts of the country where fiſh can be obtained. It cannot be very material what kind of fiſh are made uſe of for this purpoſe. The North river and moſt other rivers abound with fiſh called the alewife, or with the herring, which may be uſed for manuring fruit trees. The river ſhad are generally in too great demand for food, to be uſed for manure, but the heads and inwards, which are thrown away, would anſwer the purpoſe according to the quantity, equal if not ſuperior to any fiſh whatever.

APPENDIX.

Read February 14th, 1798.

NOTWITHSTANDING the great improvements which have been made in huſbandry in different parts of Europe and America, it is far from being aſcertained what is the largeſt quantity of produce which may be raiſed from a given quantity of land by manure, it will no doubt be much more than from

the moſt fertile land in its natural ſtate. I have heard of no inſtance of new land producing more wheat than forty-two buſhels to the acre: in Suffolk county, ſome years ago at Huntington, by manure, fifty-two buſhels of wheat were raiſed by the acre; ſince the practice in that county, of manuring land by fiſh has been in uſe, between forty and fifty buſhels of wheat from one acre, is not an uncommon crop; and by a late accidental experiment, it appears, that the product of grain from an acre, will be in proportion to the quantity of this manure, and ſo as to exceed any production we have heard of in any part of the world. A farmer in the town of Riverhead, in Suffolk county, Mr. Downs, having four thouſand fiſh called moſbankers, or menhaden, ſtrewed them, about the firſt of June, on twenty rods of ground, being a poor, gravelly, dry ſoil, and which, without manure, would not pay for the tillage. Theſe fiſh were ploughed under a ſhallow furrow; at the time of ſowing, about the laſt of September, the ground was ploughed up again, and a little deeper: by harrowing, the putrid fiſh were well mixed with the earth, and the ground ſown with rye at the rate of about one buſhel to the acre. The ground being well covered in the fall, the rye was not injured by the winter: in the ſpring the growth was remarkably rapid and luxuriant, till it was about nine inches high, when his neighbor's ſheep broke into the incloſure and eat it all off cloſe to the ground. The fence was mended and the rye grew again and much thicker than before, till it got about ſix inches high, when the ſame ſheep broke in again, and the ſecond time eat it cloſe to the ground: it was then ſuppoſed the crop would be loſt, but it grew again with additional thickneſs and great rapidity, it all ſtood well, the ears were very long and full, and Mr. Down's aſſured me he had ſixteen buſhels of rye from this twenty rods of ground. This production was ſo extraordinary, that

although I could have no reaſon to doubt the aſſertion of Mr. Downs, I converſed with ſome of his neighbors on the ſubject, who had ſeen the rye growing at different times, and juſt before harveſt, they made no doubt of the fact, and obſerved the heads and thickneſs of the rye far exceeded any thing they had ſeen or could have imagined.

This piece of land was manured at the rate of 32,000 fiſh per acre, which would coſt including the carting from the ſhore where they were taken 10s. per thouſand, which would be 16l. The product would be 128 buſhels, which at that time was worth 8s. per buſhel, which is 51l. 4s. if we allow 3 dollars for the plowing, gathering and threſhing the grain per acre, with the ſtraw, which will be fully adequate to the labor, there will remain 85 dollars clear of all expence, on the neat proceed of one acre of rye thus manured and productive; and Mr. Down's profits on the twenty rods of rye were four pounds five ſhillings. Mr. Downs, as well as his neighbors, were of opinion that unleſs the accidents of the ſheep eating off the rye twice had happened, the whole would have been loſt, by reaſon of its falling or lodging. If this opinion be right, by this experiment we are taught the neceſſity of cutting or feeding off the grain on lands highly manured, in order to preſerve the crop. Perhaps the thicker ſuch land is ſown the leſs neceſſity there will be for cutting or feeding, as there will be more original ſtrong ſtalks. Moſt lands in this country of the ſame quality, will bring more buſhels of wheat than rye, and I truſt by improvements on this experiment, which was merely accidental, we may ſoon be informed of a much larger quantity of wheat being raiſed on an acre than hitherto has been raiſed in Europe or America.

It was expected that the taking of thoſe fiſh in ſuch large quantities on the ſea-coaſts for manure, would in a few years deſtroy them, but hitherto they have

increaſed. This year I ſaw 250,000 taken at one draught, which muſt have been much more than 100 tons: one ſeine near me caught more than one million the laſt ſeaſon, which ſeaſon laſts about one month. Various are the modes of manuring the land by fiſh; thoſe that are taken early in the ſeaſon are by ſome carted on the land, ſpread lightly and plowed under the furrow for raiſing Indian corn; this corn is taken off in the fall and the land plowed and ſowed for wheat; by this mode they have two good crops by manuring once. The fiſh that are taken later are now generally carted and ſpread thinly on poor land and plowed under; before ſowing time the land is plowed again, and this proceſs is now conſidered the moſt profitable, as it ſaves the time and labor of making a compoſt, and carting and ſpreading the ſame.

On the Feeding of Hogs to Advantage.

By EZRA L'HOMMEDIEU, *Eſquire.*

Read February 28, 1798.

THE buſineſs of a farmer has been compared to a hoop which has no end; it is certain that there is no buſineſs which requires more particular attention, eſpecially to minute objects: every thing muſt be attended to, every thing muſt be ſaved, and every buſineſs done in ſeaſon. Farmers in general are not fond of trying experiments, and are more attached to their old cuſtoms than people of other profeſſions: this may ariſe from the value of their labor which they cannot ſpare from other avocations to make experiments, and from a fear of being laughed at by their neighbors if they ſhould not be ſucceſsful. The beſt way to introduce any thing new which is uſeful among farmers, is to give them occular demonſtration. As much depends on ſaving in

the farming buſineſs, I ſhall take the liberty of making ſome obſervations on the ſavings which may be made by the feeding of ſwine. It is a common practice for people in this ſtate, as far as I am acquainted, to give their hogs among other things hard corn, eſpecially when they are fatting; ſome have their corn ground, ſuppoſing they make a ſaving in feeding with meal inſtead of corn, beſides paying one-tenth for the grinding. A little obſervation convinces one that it muſt be a great loſs to feed hogs on hard corn, it is not digeſted, and a conſiderable portion is diſcharged with the dung. To avoid this evil I have been in the practice of ſoaking all my hard corn before it is given to the hogs; this I have ſeen practiſed in Connecticut, and is recommended by Dr. Elliot of that ſtate, in his eſſays on huſbandry. By the experience I have had I make no doubt but more than one-tenth part of the corn fed to hogs may be ſaved by this mode of ſoaking: it is difficult to determine what the ſaving would be in a year throughout this ſtate, if this mode of feeding with ſoaked corn was univerſally practiſed, becauſe it is difficult to fix on any data or principles by which we can determine the number of ſwine in the ſtate. I have ſuppoſed that if the inhabitants of New-York, Albany and Hudſon were ſubtracted from the whole number in the ſtate, there would not be much difference between the number of people and the number of ſwine: I ſhall take up this principle, as I can get no better at preſent, and make our calculation. Mr. Morſe, in his Gazetteer publiſhed laſt year, makes the inhabitants of this ſtate to conſiſt of at leaſt 600,000; if we deduct 70,000 for the cities of New-York, Albany and Hudſon, there will remain 530,000 which we ſuppoſe is nearly equal to the number of hogs in the ſtate. If we allow theſe hogs to eat on an average two buſhels of corn in a year, which I believe is a ſmall calculation, they will conſume 1,060,000 buſhels; if we admit that the one-tenth

part or nearly three quarts to the buſhel, which is the uſual toll for grinding, (by which many farmers think they make a great ſaving) is more than ſaved by ſoaking the corn, it will amount in one year to 106,000 buſhels, which reckoned at 4s. per buſhel, will make the conſiderable ſum of 20,200l. As we are now on the ſubject of feeding hogs, it may be of uſe to obſerve that farmers loſe much by giving freſh bran to hogs, it is eaſily obſerved by their dung, that this bran is not digeſted. Perhaps the ſtomach of a hog is ſuch that it will not take hold of a ſubſtance ſo ſlippery, which it will do when it becomes ſour; the hog then digeſts nearly the whole. A hog is partly a carnivorous animal, and lives as well on animal as vegetable food. Near the ſea-coaſts it is common to feed them with different kinds of fiſh: the horſe-feet are the beſt, eſpecially for a ſow with pigs, if they have water to go to at all times theſe fiſh exceed any other food to make the pigs grow and to ſupport the ſow. Theſe fiſh abound in eggs in the ſeaſon of depoſiting them in the ſand, and each ſhe-one will have nearly a quart, theſe muſt be very nutritious, independent of the fiſh itſelf. Other fiſh are very good for hogs, but care muſt be taken when the hogs are fed with the fiſh that they are not tainted, and that the hogs have the privilege of feeding on graſs, otherwiſe the pork will have a fiſhy taſte. Hogs do very well on white or red clover, or ſpear graſs, with little or no other food, and in many parts of the country incloſures are made ſolely for that purpoſe; but when lands are poor and manure is much wanted, it is more profitable to keep them up the bigger part of the year; the manure they make, by ſods, weeds, ſtraw and other vegetables being thrown into the pen, will more than pay for their keeping, as I have ſome years ago obſerved to the ſociety. It is very neceſſary when hogs are kept up to have a poſt ſet in the middle of the pen that they may rub themſelves with more convenience than

they can otherwiſe do. It will be convenient to have two or three veſſels or caſks for the ſoaking of corn to feed hogs, ſo that the corn may be ſufficiently ſoaked before it is given out: in cold weather or in winter it ſhould be kept in the cellar to prevent freezing. As the water in which the corn is ſoaked may be more nutritious than otherwiſe, it will be beſt to give this water as occaſion may require to the hogs to drink. As to the time neceſſary to ſoak the corn no ſpecial direction can be given, as it depends on the temperature of the weather; it ought, however, to be ſo much ſoaked, as to prevent that indigeſtion which is experienced in feeding with hard corn, and is eaſily diſcovered by the dung of the hogs. While we are on this ſubject of ſoaking corn, it may not be amiſs to mention that ſoaked corn is a much better feed for horſes than moſt other, and leſs dangerous than hard corn: I have known many farmers in this practice, and have practiſed it myſelf to good advantage; it is generally ſuppoſed that you make a ſaving by feeding Indian meal to horſes, more than to pay for the toll of grinding the corn; I have tried both, and am of opinion that a horſe will be kept in better fleſh by feeding with ſoaked corn, than by Indian meal, and that there will be a greater ſaving in the former than in the latter.

On SEPTON *(Azote) and its Compounds, as they operate on Plants as food, and on Animals as poiſon: intended as a Supplement to* MR. KIRWIN'S *Pamphlet on Manures. In a Letter to the* Rev. Dr. HENRY MUHLENBERG, *of Lancaſter, Pennſylvania, from* MR. MITCHELL, *of New-York, dated October* 24, 1796.

THE letter which you wrote me from Lancaſter, on the ſixth of June, would not have remained unanſwered ſo long, had I not been engaged in mak-

ing a tour through the ſtate of New-York, by an appointment of our agricultural ſociety, which I was prevailed upon to accept. You obſerve that gypſum has been found in Pennſylvania near Lake Erie, in large quantity; and I have the ſatisfaction to inform you, I have received beautiful ſpecimens of tranſparent lamellated gypſum, ſaid to be found plentifully in Onondaga county, in the ſtate of New-York. The powder of gypſum does wonders in the interior part of our country; for I know not whether I ſhould be extravagant if I told you that the proper uſe of it *doubled* the *productions* of the land.

But I am not diſpoſed, at this time, to diſcuſs the ſubject of gypſum with you. There is another manure, which, though exceedingly abundant and active, has been ſtrangely overlooked by moſt perſons. On account of its connection with the life and health of plants, and the diſeaſes and death of animals, it merits an eminent ſhare of attention. Some obſervations and reflections on this ſubject, which occurred to me during my late expedition, ſhall form the remaining part of this reply to your laſt.

In my letter to Chancellor Livingſton, of February, 20, 1796, an attempt was made to ſhew that plants had the power of deſtroying peſtilential fluids, and of rendering the atmoſphere, which had been contaminated by them, healthy. It was ſtated, that the ſepton (azote) was taken up as a nutrient material, and retained in the vegetable economy; while the oxygene was diſcharged, and, in company with caloric and light, renewed the reſpirable portion of the atmoſphere.

I ſhall now proſecute the inquiry a little further, and go into ſome practical details relative to this ſort of manure. This taſk I the more readily undertake, as I find the experienced and accurate Mr. Kirwan, a copy of whoſe valuable publication has been juſt ſent us from the Britiſh board of agriculture, has made no mention whatever of the ſeptous

principle (azote) as a manure. (The manures moſt applicable to the various ſorts of ſoils, &c. London, 1796.) This letter, then, may be conſidered as a ſupplement to Mr. Kirwan's pamphlet.

What I have to remark will be compriſed under three heads; 1. That animal manures contain ſepton (azote.) 2. That plants, nouriſhed by ſuch manures, contain it alſo; and, 3dly, That hence may be derived a principle elucidating the uſe and operation of ſuch manures.

1. The whole hiſtory of decaying animal ſubſtances tends to prove the abundance of ſeptic (azotic, nitric) ingredients they afford. The urine and excrements of neat cattle and ſheep, the ſoakings of dunghills, the earth of horſe-ſtables and cow-houſes, the ſoil of graves, and generally ſpeaking, animal relics, and putrefying carcaſſes of all kinds, afford every one of them ſeptic (nitric) acid. This acid is compoſed of ſepton (azote) and oxygene. Water aids the formation of this acid, by promoting inteſtine motion among the decaying materials, and by its own decompoſition furniſhing any quantity of the principle of acidity which may be wanted. And, when formed, water acts as a vehicle to convey and apply it to the various ſubſtances it meets with.

Accordingly, this product of animal decompoſition being yielded plentifully by the materials collected in yards and along ſtreets, filters through the earth in cities, and taints the waters of their wells, moſt of which, eſpecially in large and long-ſettled ſpots, are found, by experiment, to contain it, either ſeparate or combined with fixed vegetable alkali, in the form of a *ſeptite of potaſh* (nitre.) It muſt be hence apparent, that the water of ſuch wells ought not to be employed for the domeſtic uſes of waſhing, cooking or drinking; but that, in well-regulated ſocieties, aqueducts ſhould be conſtructed for bringing water to towns from ſprings or ſources conſiderably diſtant. This branch of public economy, which was ſo dili-

gently attended to by the ancient Romans, is conſidered, by American municipalities, as of ſmall importance. They had rather offer a yearly ſacrifice of hundreds of citizens to the demon of peſtilence, than make the moſt eaſy and obvious of all public proviſion for waſhing away ſuch pollution. I have often thought the ſixth labor of a great Deity of antiquity very applicable to the conſiderable towns in the United States, which may be conſidered as ſo many Augean ſtables, requiring the waters of a river to be poured through in order to cleanſe them.

In like manner, *ſtagnant lakes* are vitiated (Bergman *Analys. Aquar.* § 4.) by animal and vegetable products; while *ponds*, *marſhes* and, *puddles*, are ſtill more highly impregnated with ſimilar extractive and ſeptic matter. The fertilizing effect of ſuch waters on plants, as far the *ſeptic principle* is concerned, may be eaſily obſerved, in meadows moiſtened by theſe fluids, where graſſes and other plants poſſeſs great luxuriance. The unhealthy operation of ſuch exhalations on animals is obſervable, when, after the evaporation of theſe waters, too great a proportion of ſeptic vapour riſes for the neighboring plants to decompoſe. Our unditched moraſſes, and undrained ſwamps, reeking occaſionally with peſtilential ſteams, would remind me, if I had a diſpoſition to indulge claſſical alluſion, of the need there is of another *Hercules* to overcome another *Achelous*.

The connection there is between malignant diſtempers and dirtineſs has been already remarked by Tiſſot, (*Avis au peuple, &c. ch. ii.* § 7 *and* 8) among the peaſantry of Europe. Septic ſubſtances, the offal of ſlaughtered animals, the refuſe of houſekeeping, are when mingled in due quantity with the ſoil, juſtly ranked among the beſt fertilizers. The impregnation of land around houſes and barns long occupied with ſuch materials, is the acknowledged cauſe of its ſuperior productiveneſs. While theſe manures are mixed with earth in ſuch quan-

tity as to promote and not overpower vegetable life, their noxious effluvia are repreſſed, or their virulence counteracted by the mediation of plants. The inſtrumentality of theſe claſſes of animated beings ſeems to be intended to keep the great balance of nature in equipoiſe, and prevent either ſcale being overloaded with materials deſtructive of animal life. But it nevertheleſs ſometimes happens, that in cellars, and around country dwellings, in pig-ſtyes and cow-pens near the houſe, there are accumulated great quantities of excrementitious and corrupting ſubſtances, which, if ſeaſonably carted away, tend eminently to fertilize the fields, and promote the growth of vegetables; while, at the ſame time, by remaining, they render the houſe foul and unhealthy, by the extrication of *ſeptic vapors*. Neatneſs and elegance are thus found to be as conducive to good health as to good huſbandry. On conſidering the matter, it appears evident, that the effluvia from the neighborhood of dirty cottages and mean huts, in the country, are of a like nature with peſtilential fumes which inſinuate themſelves into foul and unventilated tenements in cities; and the reaſon is apparent, wherefore, as penury is generally aſſociated with ignorance and naſtineſs, and often with indolence, theſe diſtempers rage with ſuch tremendous violence among the poor.

When I ſee a farmer permit ſuch unwholeſome ſubſtances to collect around his habitation, I cannot help reflecting on the danger which awaits him. The manure, which ought to have been carried away and ſpread over his lots, ſerves, as it lays, but to make his family ſickly, to diſable his laborers, and lead him to the dubious and expenſive routine of phyſic; and as in common life, as well as in logic, one blunder leads to another, the want of crops, and the conſequent failure of income, drive him to mortgages, judgments, and executions, thoſe fatal expedients of law.

In like manner do I lament the indiſcretion of tenants contending in our cities, which of them ſhall obtain, at a high rent, from the diſtant landlord, *a peſtilential ſtand for buſineſs!* With the view of bettering themſelves, they venture, at all hazards, amidſt the poiſonous exhalations of the neighborhood. By and bye they are viſited by diſtempers; and as they are honeſt and ſober citizens, having no uneaſy conſcience to reproach them for their ſins, they piouſly conſider the affliction as a monition from Heaven to try their virtue. Their ſenſe of conſtancy and firmneſs forbids them to fly from the ſcourge of the Lord, and thus they religiouſly ſtick to the infected ſpot! What is the true interpretation of ſuch conduct, but that both the farmer and the trader, obſtinately perſiſting in the means of ſelf-deſtruction, are guilty of a ſort of ſuicide?

It is a fact, long ago eſtabliſhed, that great cities are the graves of the human ſpecies. It is a truth of almoſt equal importance, that the foul habitations of country people are nurſeries of peſtilential diſtempers. The ſtreet-manure of cities conſiſt of pretty much the ſame materials with the yard-manure collected about farm-houſes. Both are unhealthy for a ſimilar reaſon. The coſtly exertions of the cit, to amaſs ſeptic materials of all kinds, and from all quarters, to found his building upon, amounts to the ſame thing with the ſupineneſs of the ruſtic ſluggard, who neglects to remove them from his door.

If further proof was wanting of the real nature of theſe manures, it would be eaſy to ſtate, that, beſides the affinity of ſeptic compounds with water, they have a ſtrong attraction for other bodies. With potaſh and ſoda, of which large quantities are daily poured into the ſtreets with the ſoap-ſuds employed in waſhing, and from other ſources, the ſeptic acid forms the ſeptites of potaſh, (common ſalt-petre) and of ſoda (cubic nitre.) With lime, which, from

meaſuring, carting and building, is ſprinkled plentifully along the ſtreets, as well as in the mortar of walls and the cielings of rooms, it forms the ſeptite of lime (calcarious nitre.) And with clay it forms the ſeptite of argil, (nitrite of alumine.) By theſe ſeveral ways are peſtilential vapours kept down and prevented from exerciſing their deadly effects upon animals, except in caſes where they are produced in quantity too great for the enumerated ſubſtances, and others with which they have a proneneſs to combine, to attach and neutralize.

2. There will be no great difficulty in ſhowing, that ſepton (azote) is one of the component materials of certain vegetables. If it can be made evident what plants eſpecially abound with it, we ſhall be furniſhed with a clue, leading us to the true uſe of the manures containing it. From an analyſis of plants we have become acquainted with ſeveral of their componant parts, and thence are enabled to form ſome judgment concerning the qualities of the manure beſt adapted to ſuch and ſuch particular kinds. There is good reaſon to believe, that particular manures ought to contain ingredients of the ſame nature and quality with thoſe which the plants ſo manured, are found by analyſis to conſiſt of. By proceeding in this manner, there can be rarely a miſtake made in the application of manure. It is obſervable in the order of creation, that certain vegetable bodies approach more than others towards animal nature. The preſence of ſepton (azote) is the circumſtance in the compoſition of organized beings, which particularly denotes animality, or the approximation to it. Septic manures, being of animal derivation, ought therefore, if they entered into the conſtitution of plants, to make ſuch as are nouriſhed by them, take on ſomewhat of an animal nature. Let us now examine how this principle accords with facts. A familiar example may be taken from *wheat*. Wheat is moſt benefitted by manures

that contain ſepton. *Street-manure*, *door-dirt*, and *well-mixed barn-yard compoſt*, all of which abound with ſepton, are among the beſt manures for that vegetable. And the efficacy of wood-aſhes in making ground capable of producing great crops of that grain, is probably owing, if modern conjecture is true, to the ſepton (azote) compoſing a part of the alkali it contains. Some of the *ſwamp-manures* will alſo produce good harveſts of wheat; but others of them, though they cauſe a ſufficient growth of ſtraw, fail to fill the ſeed in the ear. The ſtraw is large and heavy enough, but the grain is ſcanty and light. The reaſon appears to be this: Where the ſwamp-manures happen to be charged with the ſeptic matters, derived from animals, or from vegetable ſubſtances that approach toward animal nature, they will produce plentiful crops of wheat; but when they conſiſt merely of decayed plants, they are incapable of elaborating the grain in the head. The cauſe of this can eaſily be inveſtigated by attending to the analyſis of wheat. Mr. Parmentier, (Le Parfait Boulanger, &c. page 26.) aſſures us of the preſence of ſepton in the *mucous* part of meal; and he affirms, that the *glutinous* portion affords products quite ſimilar to animal ſubſtances. (Ibid. p. 24.) If, then, the land upon which wheat grows, contains a ſcanty quantity of ſepton, the ſeed will be poor and light in proportion to the deficiency of that article of food in the ſoil. Yet, in this very ground, the roots of turnips and radiſhes may thrive exceedingly; and ſo may other plants that do not employ ſepton as an article of their diet.

The ſame views of the ſubject inform us why *funguſes* grow up on dunghills and in paſture grounds where the excrementitious diſcharges of animals are dropped. That they are nouriſhed by ſepton, appears from their analyſis; which proves them to contain it.

Although theſe conſiderations might appear con-

cluſive as to this point, the evidence does not reſt here. Facts of a very ſtriking nature preſent themſelves relative to the growth of plants on nitrous (ſeptic) ſoils. In general, vegetables growing in ſuch ſoils, are remarked to become very large, and to get ripe early. And as they are ſoon ripe, they are ſoon rotten. *Tobacco*, in ſuch ſituations, is very luxuriant, and quickly matures, but is very apt to rot on its paſſage from America to Europe; and too much ſepton in it ſeems to give it the bad quality of going out very readily after it is ſet on fire for ſmoaking. *Potatoes* grow rapidly and large, but will keep only for a ſhort time; *Sugar-canes* grow very rank, and are ſoon fit for cropping, but muſt be manufactured ſpeedily, or they ſpoil, and even with the earlieſt care and beſt attention, afford, under ſuch circumſtances, ſugar and molaſſes of a quality below middling. (Stubbs. 3 Lowthorp's Abridgement, p. 554.) *Cabbages*, for the ſame cauſe, ripen too ſoon, corrupt in the head, and laſt not long enough for winter uſe.

What *Pliny* relates on the cultivation of the Helvenac vine, (Nat. Hiſt. L. xiv. de gener. Vitium.) confirms the ſame principle. "There is no vine," ſays he, "which is leſs accommodated to the ſoil of "Italy; the grape which it bears is clear, ſmall and "very apt *to rot*; and the wine it affords will not laſt "longer than a year; but there is no plant that "thrives better in poor land."

If theſe ideas are juſt, then the decay of ſuch vegetable ſubſtances ought to be attended, under certain circumſtances, with the production of ſeptic or peſtilential fluids. This too is the fact. *Cabbages*, putrefying in a cellar, have been known to render a houſe unhealthy. Corrupted *Coffee* has been charged with emitting peſtilential effluvia enough to deſolate a neighborhood. The like may happen from rotten *flax*, *hemp*, *potatoes*, *onions*, and in ſhort, all other plants which have derived ſepton, or the principle of putridity, from the ſoil in which they grew. It is

probable, that rotten wheat contributed, with other cauſes, to render the vicinity of a certain ſtore in New-York, during the peſtilence of 1795, peculiarly unwholeſome. The diſpute, whether peſtilential effluvia proceed from animal or vegetable putrefaction, ſeems thus reduced to its proper principle: When vegetables, containing ſepton, go into putrefactive decay, miſchievous gaſſes may exhale from them, having the qualities of animal productions. When this is not the caſe, collections of putreſcent vegetable matter, as in peat-moſſes and bogs of turf, emit no particularly offenſive miaſma to vitiate the ſurrounding air; but, on the contrary, the water draining from ſuch places is often potable and good.

3dly. There now occurs an obvious explanation of one of the operations of lime as a manure, when mingled with dung and ſoil. The common opinion has been, that it promoted the putrefactive proceſs of animal and vegetable matters, and thus made them more fit for abſorption and nutrition. This may be the caſe: but there is yet another effect which has not been generally attended to. Calcarious earth combines with the ſeptic acid into a ſeptite of lime, (calcarious nitre) and thus becomes a very valuable manure; and at the ſame time, by its attractive power, it prevents the evaporation of that fluid in the form of peſtilential ſteam. I believe, likewiſe, it has a further uſe in retaining the ſeptic ſubſtances longer on the land, and thereby lengthening out their fertilizing effect. Old walls and rubbiſh, abounding with the ſeptite of lime, frequently anſwer valuable purpoſes, as manures. Lime, in its ſimple ſtate, deſtroys vegetation. Before it is fit to promote the growth of plants, it muſt be combined with ſome neutralizer. Its combination with carbonic acid, (fixed air) is the moſt frequent; but in dunghills, and heaps of manure, a more common compound is formed with the ſeptic (nitric) acid. By this connection, both the lime and the acid are

deprived of their cauſticity, and preſerved upon the land a ſufficient duration of time, to undergo that gradual decompoſition, by the vegetable economy and other cauſes, which favors the production and growth of plants.

How far the other ſeptites may be operative as manures, is not wholly aſcertained. Doubtleſs they poſſeſs no inconſiderable activity. It ſeems to be agreed among the learned, that the word tranſlated 'nitre' in the bible (Prov. xxv. 20. Jerem. ii. 22.) does not mean the ſalt-petre of the moderns, but the mineral alkali (ſoda.) Yet ſome ambiguity beſets the text of Virgil, (I. Georgic. v. 194.) as to the preciſe thing he meant by the "nitro" ſometimes employed with the lees of oil, as a ſteep to prepare ſeed for ſowing. The following facts will render it probable that ſeptic or peſtilential fluids are ſometimes very abundant in the atmoſphere, and diſpoſed to combine readily with ſuch ſubſtances as have an attraction for them; and that conſequently in both the caſes juſt referred to, the *nitre* might have been a *ſeptite*.

"Nitre," ſays *Querlon*, (Not. ad Plin. Nat. Hiſt. L. xxi. chap. 10.) "is a ſalt belonging to all the parts of "the terreſtrial globe, inhabited by men, by animals, "or even by *inſects;* for I have often extracted very "pure ſalt-petre from the little holes in walls which "ſerved as lurking-places for *ſpiders*. Animal ex- "halation ſeems to be the means employed by nature "to produce nitre, which, on that account, is never "produced either far below or above the ſurface of "the earth; and uſually has for its matrix rotten "plaſter, ſimilar calcarious matters, &c."

In many parts of the ſtate of New-York, much of the fixed vegetable alkali is extracted from wood-aſhes. The interior country, as well as the capital, is occaſionally ſeverely afflicted with peſtilential diſtempers, as was the caſe in the ſummer and autumn of the current year. At ſome of the pot-aſh works,

ſuch was the amount of ſeptic fluids in the ſurrounding air during this ſeaſon, that the alkali concreting on the outſides of the leach-tubs, from the leakage through the ſtaves, attracted enough of them to convert it to ſalt-petre. Such a fact is of the utmoſt weight and importance, and of itſelf eſtabliſhes the baſis of moſt intereſting deductions.

From the copiouſneſs of ſeptic products, it is apparent, they incommode animal life wherever they are ſufficiently concentrated; they become incorporated with metallic, earthy and ſaline bodies, wherever they can find them; and they extend their influence to unknown limits over the vegetable creation.

Here, however, I muſt conclude, with ſoliciting your aſſiſtance to aſcertain ſome points which appear to me of no inconſiderable importance, both when conſidered as ſpeculations in ſcience, and as viewed in connection with the practical arts of agriculture and medicine. What are the effects wrought upon plants by the ſeptites of pot-aſh, (common nitre,) clay, (alumen nitroſum,) and ſoda, (cubic nitre) conſidered as manures?

As I offer to join heart and hand with you in purſuing theſe inquiries, and have made ſome arrangements on my farm for the purpoſe, it is almoſt ſuperfluous in me to obſerve, that I remain with unabated eſteem,

Your's, *&c.*

On the Method of Tarring Seed Corn, to prevent its being deſtroyed when planted.

By JAMES G. GRAHAM, *Eſquire.*

Read February 28, 1798.

MAISE, or Indian corn, being a production of primary importance to the inhabitants of the

United States, therefore, any diſcovery which may tend to ſecure a crop of this valuable grain from the accidents and ravages, to which, in its infant ſtate, it is peculiarly liable, muſt he highly intereſting to practical farmers, and pleaſing to this ſociety.

Numerous are the experiments which have been made to preſerve it from the attacks of its various enemies; but among the many that have fallen under my obſervation, none has ſo happily ſucceeded as that of tarring the ſeed, ſhortly before planting. This is moſt ſucceſsfully performed in the following manner: Put as much corn as you expect to plant the next day, into warm water in the evening; on the enſuing morning drain off the water, which will then be cold; then pour on as much hot water as will ſerve to cover it, and immediately after throw in tar, at the rate of about one pint to a buſhel; ſtir the tar through the corn with a dung-fork, or ſpade, until the grains appear to be uniformly coated with the tar, then put it into a baſket to drain; after the water has ran off, throw it into a large tub or trough and, ſtir among it as much aſhes, lime or gypſum as will adhere to the grains, by which means they will eaſily ſeparate from each other, and may be as conveniently planted, as if they had never been tarred. I prefer gypſum, in the above proceſs, to either lime or aſhes, as it will not be ſo likely to injure the fingers in planting, and does alſo in equally ſmall quantities, more powerfully promote vegetation.

The precaution of ſoaking the corn, before applying the tar, is highly neceſſary, as the coat of tar and plaiſter would otherwiſe, eſpecially in dry ſeaſons, prevent it from abſorbing moiſture ſufficient to produce vegetation.

It is of importance too, in all caſes where corn has been ſoaked, to plant it immediately after the plough when running the croſs-furrows.

I have experienced the good effects of thus preparing ſeed corn, principally in preventing the rava-

ges of crows and black birds, the moſt common enemies of our ſpringing crops, but have no doubt that it will be found equally beneficial in preſerving them from others, ſuch as worms, ground-ſquirrels, &c. who generally chuſe their food by ſcent; and that of the tar being ſtrong, permanent, and to moſt inſects and animals very offenſive, it promiſes fair to prevent their attacks and ſecure the grain until it becomes quite putrid, and the riſing plant requires ſufficient ſtrength to draw its nouriſhment from other ſources.

I have frequently thrown corn thus prepared, to hogs and dung-hill fowls, who have always refuſed or neglected to eat it, though left in their way for ſeveral days.

An Account of extraordinary Crops of Corn, raiſed by Means of Street Manure.

To the Secretary of the
Agricultural Society of New-York,

A FEW days ago I ſaw republiſhed in the newſpapers of this city, an extract from a Jerſey paper, giving an account of the great fecundity of the ſoil in the neighborhood of Elizabethtown; 155 buſhels of Indian corn in the ears had been produced from an acre of land. This was certainly a great crop; but this falls vaſtly ſhort of what *may* be gotten off an equal quantity of ground. As an incitement to the ſpirit of emulation and induſtry among farmers in the United States, I ſhall now lay before them a ſhort account of the reſult of two crops of three acres each, which were planted in the neighborhood of this city, in conſequence of a wager of fifty guineas. In purſuance of the terms of this bet, which were reduced to writing, the ground in which

the crop ſtood, belonging to each party, was accurately meaſured; and when gathered, each crop was meaſured by a perſon ſent by the adverſe party, for the expreſs purpoſe. From the nature of the caſe it is evident, that the reſults of theſe crops of corn would not fail of being aſcertained with the utmoſt attention to accuracy. One common meaſure was made by both parties, and upon ſhelling out the ears contained in this meaſure, the produce of each crop was as follows:

The produce of the crop raiſed by Mr. John Stevens, of Hoboeken; ſum total of meaſures full of corn in the ear, 233 2-3. A meaſure full contained one buſhel and a half and one pint of ſhelled corn; 233 2-3 give, conſequently, 354 buſhels and 6 quarts, or 118 buſhels and 2 quarts per acre.

The produce of the crop raiſed by Mr. Daniel Ludlow, of Weſtcheſter, is as follows:

Total, 182 meaſures of corn in the ear. Shelled corn in a full meaſure, one buſhel and a half and 4 quarts; which in 182 gives 295 buſhels and 12 quarts, or 98 buſhels and 14 quarts per acre.

Theſe are truly noble crops, and do honor to the induſtry and agricultural ſkill of the cultivators; and as each of the gentlemen have in their mode of culture deviated from the common routine of practical farmers, a ſhort account of the proceſs adopted by each, cannot fail of proving uſeful and inſtructive to the members of the ſociety, and to every American farmer.

I have not had an opportunity of obtaining any minutes from Mr. Ludlow himſelf reſpecting his crop; but am informed that he planted his corn in continual rows, at about four feet aſunder, and about 8 inches from ſtalk to ſtalk in the rows; and that he manured his ground with 200 horſe-cart-loads of *ſtreet dirt*.

Mr. Stevens informs me, that he gave his ground three plowings before planting, and before the laſt

plowing put on 700 horſe-cart-loads of *ſtreet manure*; that he planted in double rows at 5½ feet aſunder; that he was at the pains of dibbling in each grain. To do which with expedition and accuracy, he bored two rows of holes in a piece of board of about four feet long, ſo as to form equilateral triangles, the ſides of which were ſeven inches, as thus,

- - - - - - - -

- - - - - - - - Into theſe holes he drove pegs about 3½ inches long. As the corn was dropped into theſe holes, made with this machine, a man followed with a baſket of rotten dung, with which he filled them up. Then came on the carts, out of which the rows were ſprinkled with a coat of *ſtreet manure*. During the ſeaſon the crop was ſuckered three times. The intervals were repeatedly plowed, and the rows kept perfectly clean of weeds, by hoeing and hand-weeding.

But extraordinary as this crop muſt appear, Mr. Stevens is confident that he ſhould have had conſiderably more corn, had not his crop ſuffered very greatly by a thunder-ſtorm, which laid the greater part of it down at the time the ears were ſetting.

AGRICOLA.

Method of procuring new Varieties of Potatoes.

By SIMEON DE WITT.

Read February 21, 1798.

IT has been obſerved that potatoes long propagated from the roots, will degenerate in quality. It is therefore neceſſary in order to procure a ſtock in its natural perfection, to have recourſe to the ſeed which the plant bears on its branches. The method of doing this as proved by experiment to be ſucceſsful, is as follows:

I gathered what are commonly called the potatoe-apples, when they were fully ripe, and had partly dropped from the ſtalks, and laid them away in a corner of the garden covered over with potatoe-vines and other vegetable rubbiſh, where I left them for ſeveral weeks, till they had become ſo ſoft as to be eaſily ſqueezed or maſhed in the hand; then taking a baſon of water I preſſed out the pulpy matter containing the ſeeds, and mixed it thoroughly with the water. On ſuffering the baſon afterwards to ſtand quiet for a little time, the ſeeds ſettled to the bottom, while the other matter remained ſuſpended, which being then poured off, left the ſeed almoſt clean; and by repeating the waſhing in this manner once or twice, I obtained it perfectly clean and fit to be dried and put up for uſe. Early in the ſpring I prepared a bed, and having made drills in it at proper diſtances from each other, I ſowed the ſeeds in it exactly as I would ſow the fineſt flower-ſeeds. In due time I had the ſatisfaction to ſee them apparently all vegetate. The firſt appearance of the plant above ground, is with two ſmall leaves almoſt triangular, each about one-tenth of an inch in diameter. They were ſoon attacked by the ſmall flea-like bug that devours the leaves of young raddiſhes, turnips and other acrid vegetables; in conſequence of which, I had but few remaining. Theſe I left in the bed: they grew rapidly and almoſt to the length of the plants raiſed from the roots. The ground was hoed up againſt them from time to time, and in the fall, when I dug them up, I found the roots ſtrung along with potatoes of all ſizes, from about an inch and a half, to that of a pea. Thus far only I have gone with the experiment. The next thing to be attended to, is to ſeparate theſe young potatoes into as many parcels as there are varieties, for you will have them of various kinds, and the following year to plant them in as many diſtinct places, and to manage them in the ordinary way. This ſea-

ſon will bring them to their full ſize and perfection, and enable you to make trial of their comparative qualities; thoſe of ſuperior excellency will of courſe be ſelected for a new ſtock.

I did not remove any out of the beds where they were ſown; but the proper way I believe, would be to tranſplant them ſoon after they are up, ſo wide apart from each other, as will leave plenty of room for hoeing and for the roots to run to a ſufficient diſtance without incommoding each other.

If the practice of raiſing new ſtocks of potatoes from the ſeed were generally adopted, I have no doubt it would be the means of improving the ſpecies of that moſt valuable vegetable, to which the ſoil of America, as its native country, ſeems to be peculiarly favorable. It therefore, in my opinion, deſerves to be recommended to every perſon who takes pleaſure in becoming the benefactor of his country by attempts to improve thoſe productions of nature which are neceſſary for the ſupport, and tend to multiply the delicacies and luxuries of life.

Mr. Noah Webster *on raiſing Potatoes; in a Letter to Secretary* Mitchell.

Dear Sir,

YOU know my love of the firſt and beſt occupation of man, *agriculture*, and how anxious I am to ſee this moſt uſeful buſineſs improved among my fellow-citizens. In my preſent ſituation, I have not an opportunity to make experiments on a large ſcale; but ſome obſervations made the laſt year, on the growth of potatoes, may poſſibly be worth the notice of the agricultural ſociety. From a ſingle experiment, I am led to the following reſults:

1. The ſeed-potatoes ſhould be thoſe of full

growth. If ſmall potatoes are planted, they will produce perhaps nearly the ſame weight, but the new potatoes will be moſtly ſmall. I judge that full grown potatoes will produce double the number of thoſe which are large and fit for uſe.

2. Cuttings produce more than whole potatoes. This has been fully demonſtrated by others.

3. The Engliſh whites grow to perfection in a *ſhorter time* and in a *poorer ſoil*, than the red. The difference is eſſential. They are therefore beſt for early potatoes.

4. Potatoes will not come to perfection without the ſun. Therefore nothing is ſo prejudicial as to plant them too thick, eſpecially on a rich ſoil. The white potatoes will anſwer tolerably well on light, thin ſoil, with hills or drills at three feet diſtance. But if the ſoil is rich, the ſtalks of the potatoes will have a luxuriant growth, and cover the whole ſurface with ſhade. This will inevitably mar the crop. The hills ſhould be not leſs than four feet aſunder; and in a very rich ſoil, a greater diſtance may be better. The ſame of drills.

5. The cuttings in drills, where the land is light, will anſwer well at nine inches diſtance. This indeed ſeems to be a good diſtance for the whites. But in rich land, and eſpecially if the potatoes are of the red kind, the ſtalk of which grows to a larger ſize than that of the whites, the diſtance ſhould be not leſs than twelve or fifteen inches. The red require richer land than the white.

If theſe obſervations contain any thing not generally known, you are at liberty to lay them before the ſociety. If not, the communication you will pleaſe to ſuppreſs.

I am Sir, your obedient ſervant.

New-York, April 28, 1797.

On the Cultivation of the Poppy-Plant, and the Method of procuring Opium, &c.

By Dr. Shadrach Ricketson,
of Dutcheſs County, New-York.

[From the American Magazine.]

OPIUM is the produce of the *papaver ſomniferum* of Linnæus, which, as a genus, comprehends two ſpecies, viz. 1. The double; 2. the ſingle; each of which includes ſeveral varieties as to the colour of the flowers, ſome being white, ſome red, others purple and variegated.

From hiſtory we are told, that in the ſeveral provinces of Aſia, it is the large white poppy only that is cultivated for the purpoſe of collecting opium; but, from the trials that I have made I am of opinion that it is a matter of indifference which ſpecies or variety of the plant is cultivated for medicinal uſe, as they all afford, when tapped, a juice that is ſimilar as to quantity, colour and every other reſpect, both freſh and when dried: however, I have thought that the large double ſpecies produces the greateſt number of heads, and conſequently the greateſt quantity of juice from one ſeed; but of this I have not yet had ſufficient trials to be certain.

Among the poppies cultivated with a view to make the preſent experiments, I had ſome that had thirty heads a piece, all of which ſprung from one ſeed, and from one original ſtalk.

The poppy ſeeds in this country ſhould be ſown or planted about the middle of May, in rich, moiſt ground.

The ground ſhould be formed into areas of about four feet in width. The ſeeds ſhould be planted at about ten or twelve inches diſtance in tranſverſe rows, which ſhould alſo be about the ſame diſtance from each other.

Shallow holes of an inch depth ſhould be made in the rows at the diſtance mentioned; the ſeeds put in

and covered over even with the ground; after which they are ſuffered to remain till the plants are grown about four inches high, when, eſpecially if the land is dry and not fertile, they may be frequently watered and manured, the beſt for which laſt purpoſe is ſaid to be a compoſt of dung, aſhes, and a nitrous earth.

They are ſaid in the Eaſt-Indies to water them again profuſely juſt before the flowers appear; but as I have had them grow very luxuriant and ſucculent in good ground, without either manuring or watering, I am diſpoſed to think that the advantages ariſing from this laſt particular, are not adequate to the trouble of doing it.

It is ſcarcely neceſſary to remark, that the plants from the firſt coming up, ſhould be kept clean from weeds and the like, which may be done with very little trouble with a ſmall hoe, eſpecially if the ſeeds are planted after the manner I directed, that is, in rows.

Having ſaid all that is neceſſary on the cultivation of the plant, I ſhall now proceed to deſcribe the method of obtaining its juice, which, when inſpiſſated to a pilular conſiſtence, is called opium.

The ſtates of the plants wherein I have found them to yield the moſt juice, are juſt before, in the time of, and immediately after flowering.

The plants being arrived to one or other of the ſtates above mentioned, we then proceed to that part of the proceſs called tapping, which we are told is done in Aſia, by making two or three longitudinal inciſions in the half grown capſules, without penetrating their cavities, at ſunſet, and the plants ſuffered to remain till morning, when the juice is to be ſcraped off and worked in a proper veſſel, in a moderate heat, till it becomes of a pilular conſiſtence; which method, with ſeveral others, I have tried, but none have ever ſucceeded ſo well with me, as, in a ſun-ſhining day, to cut off the ſtalks, at about an inch

diſtance from their flowers, or capſules, and as ſoon as the juice appears, which it does at firſt equally well on the part of the ſtalk cut off with the capſule or flower as on the ſtanding part, to collect it with a ſmall ſcoop or penknife, the laſt of which I have found to anſwer the purpoſe very well. After the juice ceaſes to appear on the top of the ſtanding ſtalk, it ſhould be cut off about an inch lower, when it will be found to yield almoſt as freely as before, and repeated as long as any juice appears.

The juice, when collected, ſhould be put into an evaporating pan, placed in the ſun's heat, and frequently ſtirred, till it becomes of a conſiſtence to be formed into pills, or made into rolls for keeping or tranſportation.

The quantity of opium that may be procured, depends very much upon the largeneſs of our plants, and the care uſed in collecting it. From one poppy-plant, I have produced ſeven grains of the inſpiſſated juice.

If any would chooſe to have the opium freed from its impurities, it may eaſily be done by preſſing the juice before it is evaporated through a linen ſtrainer; but if pains be taken according to the foregoing directions, I believe there will be little or no occaſion for it.

On the WEANING *of* CALVES.

By LEMUEL CLIFT, *Eſq.*

To the Agricultural Society of the State of New-York.

GENTLEMEN,

I BEG leave to communicate to the ſociety the method which I have practiſed in raiſing young calves, and which I have found to be the beſt and

cheapeſt, that has come to my knowledge. Take the calf from the cow, at two or three days old; then milk the cow into a pail, and while the milk is warm, learn the calf to drink, by holding his head in the pail, and if he will not drink, put your hand in the milk, with your finger in his mouth, the calf will then ſuck the milk; by this method he will ſoon learn to drink without the finger.

After the calf has been fed on new milk for two weeks, you may then ſkim the cream off the milk, and give it to your calves, by adding one half or more of flax-ſeed broth or tea, prepared in the following manner:

Take about one gill of flax-ſeed for each calf, and boil it well in four or five quarts of water till it becomes thick, this will be ſufficient for twenty-four hours; or you may prepare enough at once to laſt three or four days, provided the weather is not ſo warm as to make it ſour before it is uſed.

By mixing the above preparation with the ſkimmed milk, in about equal quantities, the calves' bodies will be kept in regular order, and grow as faſt and look as well as though fed on new milk; always take care to have the food as warm when given to the calves, as the milk immediately from the cow.

As the ſpring of the year is by far the moſt favorable time for making butter, by treating your calves in the above manner, you will be able, in the ſix or ſeven weeks which are contemplated to keep them before they are fit to wean, to make as much butter as the calves will be worth, which will be a very great ſaving for thoſe who wiſh to raiſe their calves.

All which is duly ſubmitted by, Gentleman,

Your moſt obedient and very humble ſervant.

Southeaſt, Dutcheſs county, April 5, 1798.

A Memoir on the Onondaga Salt Springs and Salt Manufactories in the State of New-York. By BENJAMIN DE WITT, *M. D. Fellow of the American Academy of Arts and Sciences, &c. and Secretary to the Society.*

Tales ſunt aquæ qualis terra per quam fluunt.

Plinius.

Introduction.

THE remarkable ſalt ſprings in the weſtern part of our ſtate, preſent a ſubject for inveſtigation equally curious, intereſting and important: it is therefore ſurpriſing that they have hitherto almoſt eſcaped the notice of naturaliſts and philoſophers. Nothing of conſequence I believe has yet been publiſhed concerning them; and it would hardly be known that they had an exiſtence, were it not for the verbal accounts of a few, who have had the curioſity to viſit them as they paſſed through the country. They appeared to me worthy of ſome attention, and accordingly I have made a number of obſervations and experiments concerning them; ſome of which I propoſe to communicate to the ſociety in the preſent paper.

Theſe ſalt ſprings, from their general importance, might deſerve to be conſidered in ſeveral points of view; for inſtance,

1ſt. As an object of natural hiſtory. Being one of thoſe ſingular and valuable productions with which bountiful nature has enriched our country; it would be intereſting to have a minute and accurate deſcription of their ſituation and appearance; of the various phenomena which they exhibit, and of the nature and origin of the waters.

2dly. As an object of chymiſtry. It would be equally intereſting to have an accurate analyſis of the waters, aſcertaining the various heterogenous ſubſtances which they hold in ſolution, and the juſt

proportion of each; together with an enquiry into the manner of their formation, and by what proceſſes in nature, they become thus impregnated. It is much to be regretted, that whilſt we are well acquainted with moſt of the famous mineral waters in the European world, we ſhould hitherto have had ſuch a very imperfect knowledge of thoſe which immediately ſurround us in our own country, equally, if not more valuable and uſeful.

3dly. In a medical point of view. An inquiry into the nature and cauſe of that malignant fever which every autumn prevails in the vicinity of the ſprings, and proves uncommonly mortal to the inhabitants,* moſt probably produced by ſome aerial exhalations which they emit, might poſſibly lead to a method of prevention, which would be an object of primary importance to the ſucceſs and increaſe of the manufactories. Such an inveſtigation might further lead to a developement of facts that would throw ſome ſparks of light upon the nature of peſtilential fluids and the cauſes of malignant diſeaſes.

4thly. In a political point of view; as affording a ſource of revenue to the ſtate, under the regulations eſtabliſhed by the legiſlature, and ſupplying our country with ſalt of its own manufacturing, ſo much cheaper than it can be imported.

5thly. As an object of manufactory. It would doubtleſs be pleaſing to every member of this ſociety, at leaſt to be acquainted with theſe infant manufactories, which promiſe ſo much future importance and uſefulneſs, to examine into the method and the apparatus by which the ſalt is procured from the wa-

* The diſorder which prevails about the ſalt ſprings is a remitting billious fever. It affects ſo univerſally that very few who remain near them eſcape an attack. This obliges the inhabitants and manufacturers to remove, during the two or three warmeſt ſummer months. It appears to be particularly mortal to young children, for I am informed that one ſummer, nine out of ten died. Thoſe who reſide there for ſome time become leſs liable to the attacks of the fever than ſtrangers.

ters, and to enquire whether there is not room for many uſeful improvements.

In all theſe reſpects it is preſumed they are not unworthy the notice of the naturaliſt, the chymiſt, the phyſician, the ſtateſman and the manufacturer; and as they are capable of affording a large ſupply of this neceſſary article of ſubſiſtence, to the inhabitants of a vaſt tract of country, they will become a mine of incalculable value to the community at large.

But however intereſting it might be to take ſuch a general view of the ſubject; it would be too extenſive for the limits of a ſingle communication, and perhaps in ſome meaſure foreign to the buſineſs of the ſociety. I ſhall therefore content myſelf at preſent with conſidering them principally in the laſt point of view, as an object of manufactory; being a branch of the ſubject more immediately embraced by this inſtitution. It will be neceſſary, however, in order to render the account more intelligible, to prefix a deſcription of the ſituation and appearance of the ſprings, and the nature and contents of the waters.

Deſcription of the Salt Springs.

THE ſalt ſprings, which I propoſe now to examine are ſituated in the north weſtern part of the ſtate of New-York, in the county of Onondaga, at the head of the Onondaga, or Salt Lake, about 150 miles from the city of Albany, in lat. 43° 4' 30" N. long. 1° 5' W. of Philadelphia.

The Onondaga lake is about ſix miles long, and on an average one mile wide. It is ſupplied with water by a number of rivulets, and empties itſelf by a ſhort outlet into the Seneca river, ſufficiently large to be navigated with batteaux. The water is tranſparent and abounds with fiſh; its taſte is perfectly freſh, notwithſtanding the numerous ſalt ſprings which continually flow into it. This is the caſe however only on its ſurface, for I am informed that by

ſinking a corked bottle to the bottom of the lake, and then withdrawing the cork, ſalt water is brought up. Water impregnated with ſalt being ſpecifically heavier than freſh, would naturally move along the bottom, and continue there, unleſs brought up and mixed by ſome great commotion of the waters. This can plainly be diſcerned, where the ſalt water iſſues from the ſprings into the freſh water of the ſurrounding marſh; various light ſubſtances may be ſeen ſwimming ſome diſtance below the ſurface, between the ſalt and freſh water; theſe ſubſtances being of a ſpecific gravity, lighter than the one and heavier than the other. The bottom of the lake where it can be ſeen in ſhallow places, has a white appearance almoſt peculiar to itſelf, except the ſpots which are covered with a ſingular ſpecies of moſs, growing there in abundance. This white appearance is moſt probably produced by the precipitation of a calcarious earth from the water; and this conjecture is confirmed by the circumſtance of the ſalt water holding a large quantity of lime in ſolution.

The head of the lake is ſurrounded for ſome diſtance by marſhy and ſwampy ground, interſperſed with a few large trees and buſhes, but abounds moſt with flag and wild graſs. The ſalt ſprings iſſue for the moſt part from this marſh, near the banks by which it is bounded, at various diſtances from the waters of the lake. The principal ſprings, which are moſt highly impregnated with ſalt, and which ſupply the greater number of the manufactories at preſent eſtabliſhed, iſſue from the marſh in a group at the foot of the declivity formed by the upland on which the village of *Salina* is ſituated, commonly called the Salt Point, near the place where the Onondaga creek empties itſelf into the lake. There are however numerous other ſalt ſprings diſcovered in different parts of the marſh; ſome along the ſhores of the lake, ſeveral miles down, others a conſiderable diſtance up the Onondaga creek; and what is

remarkable, they have been found to riſe in ſhallow places from the bottom of the lake, at ſome diſtance from the ſhores. All theſe however are not ſo ſtrongly impregnated with ſalt as thoſe before mentioned at the Salt Point.

The ſprings iſſue from the black mud which compoſes the marſh, by ſmall orifices, apparently in a perpendicular direction. The manufacturers, for the conveniency of pumping the water into conductors which lead to the evaporating pots, conſtruct ciſterns or reſervoirs where the ſprings appear. The ſuperfluous water from theſe as well as that from the ſurrounding marſh, is emptied into a ſmall bay or harbor a few yards from the ſprings, large enough to contain fifty or ſixty boats at once, as if deſigned by nature for the expreſs conveniency of exporting ſalt. This bay communicates with the lake by a ſhort outlet, but ſufficiently deep to be navigated with the flat boats and batteaux which are uſually employed.

The marſh ſurrounding the ſprings for a few yards, is entirely deſtitute of graſs and all other vegetables, except ſome ſamphire, (*crithmum* of Linnæus;) and when the ſun ſhines, the water is evaporated from the ſurface of the mud, leaving it covered with chriſtalized ſalt, reſembling hoar froſt.

It is remarkable that all the dead vegetable ſubſtances which happen to be within the reach of the ſalt waters, aſſume a reddiſh brown colour; hence all the bruſhes, old ſticks and various kinds of timber ſcattered about the ſprings, and even the troughs (generally made of white cedar) through which the water is conducted to the boilers, in a ſhort time acquire this colour: not only dead vegetable ſubſtances, but even growing vegetables and ſtones are thus changed in appearance. I have obſerved, however, that this red colour extends no farther than the ſurface of both vegetables and ſtones. The internal part of old wood being invariably black, and that of the ſtones natural. It may therefore be produced

merely by the depoſition of a red, earthy matter, upon theſe various ſubſtances.

Salt ſprings are diſcovered and characteriſed by thoſe who ſearch for them, by the abſence of graſs and flags; by the red colour of the mud, and old wood which may happen to be ſcattered there; if the marſh be covered with water, by its temperature being much colder than the ſtagnant water; and alſo by the appearance of a continual bubbling from the bottom, in conſequence of the air which is perpetually extricated from them.

Vegetable ſubſtances appear to putrefy much ſooner in the vicinity of the ſalt waters than in any other places; hence, even when the weather is but moderately warm, there is always a very diſagreeable putrid ſmell near the ſprings, and in mid-ſummer I am informed it becomes almoſt intolerable. We could very plainly obſerve this diſagreeable odour as ſoon as we approached near the outlet of the lake, in going up the Seneca river in the month of June. On account of the ſhallowneſs of this outlet, it is probable that the ſalt water which had been gliding along the bottom of the lake, became there mixed with the freſh, and by expoſure to air, excited an incipient putrefaction in the various ſubſtances capable of undergoing that proceſs. Nothing of the offenſive ſmell was perceived while we were croſſing the lake, but it recurred again in a much higher degree as ſoon as we approached the ſhore near the ſalt ſprings. This may perhaps be accounted for by the well known experiments, which prove that a ſmall quantity of ſalt diſſolved in water, accelerates and promotes putrefaction; whereas a ſtronger impregnation becomes highly antiſeptic. This putrefactive proceſs takes place in an extraordinary degree, only in thoſe ſituations where the ſalt waters mix with the freſh; for the undiluted waters of the ſprings themſelves are ſufficiently impregnated with ſalt effectually to preſerve both vegetable and animal ſubſtances; being

ſtronger than the pickle uſually made to preſerve beef. As a proof of this I need only mention, that in almoſt every ſpring there are occaſionally found ſeveral dead frogs, that have accidentally plunged into them inſtead of freſh water, and inſtantly died. Theſe frequently remain there for a long time, perfectly preſerved, without any putrid ſmell.

The bottoms of the ſprings appear to be compoſed of ſolid rock, for by running down an iron inſtrument into them, it uniformly proceeds ſix or ſeven feet through the mud, and then is obſtructed by a ſolid obſtacle, which can plainly be felt to be ſtone; I am informed by thoſe who have dug into the ſprings, that the ſtreams of ſalt water appeared to riſe perpendicularly from the bottom, whereas thoſe of freſh water where they happen to occur in theſe places have a horizontal direction, and more ſuperficial. This obſervation confirms the ſuppoſition that the ſalt water is forced directly upwards, through the interſtices of the calcarious rock, which probably covers a large body of ſalt; and that the veins of freſh water, being entirely ſeparate, make their way in a horizontal direction from the ſpringy ridge at a ſmall diſtance; this too will explain how it happens that ſeveral good freſh ſprings without a particle of ſalt are found at the foot of this ridge, not ten yards from ſome of the ſalt ſprings. Sticks of wood have been dug up from the bottom of ſome of the ſalt ſprings, which have been found incruſted with a ſubſtance of a metallic appearance; I could not procure any of theſe for examination.

The reſervoirs and ſprings of ſalt water are uſually covered with a pellicle of extreme tenuity, reflecting the rays of light in variegated colours, ſimilar to that which occurs upon the ſurface of the water in tar vats: this is probably a bituminous oil which riſes with the water from the bowels of the earth.

There is continually emitted from the bottom of the ſprings a large quantity of an *aerial fluid* which

bubbles from the ſurface of the water. By inverting a bell glaſs in the ſprings, I collected in a very ſhort time a conſiderable quantity. As it riſes from the bottom it appears to be entangled by the mud, for by running down a ſtick repeatedly it is diſengaged ſo faſt, as to cover the water with bubbles, reſembling a boiling pot. A burning candle being put into this air, thus procured, was extinguiſhed in an inſtant of time, and that after the veſſel had ſtood open for a little while. From this experiment I conclude it to be fixed air,* (carbonic acid gas;) characteriſed, by its being totally incapable of ſupporting combuſtion, and by its greater ſpecific gravity than atmoſpheric air, in remaining for ſome time at the bottom of the veſſel, although it was open. It is no uncommon thing to find this air generated in the bowels of the earth in great abundance. It frequently manifeſts itſelf in deep mines, and ſometimes proves fatal to the miners: hence they call it choak damp, to diſtinguiſh it from the inflammable air which alſo ſometimes occurs, this is called fire damp; it is ſuppoſed alſo that it is the ſame air which iſſues from the famous Grotto del Cani in Italy, and is ſo noxious to animal life.

This air as it riſes through the water does not however appear to incorporate with it, at leaſt not in any perceptible degree; for the water has none of that ſparkling brightneſs, nor the pungent odor, which is characteriſtic of this gas when united with common water; on the contrary it appears flat and heavy. The air in this inſtance is probably produced by the decompoſition of lime-ſtone, which we know contains it in abundance, and the ſalt water holds a conſiderable portion of lime in ſolution. It is probably partly diſſolved by means of the muriatic acid, (ſpirit of ſea ſalt,) this having a ſtronger at-

* This air has received a number of different names by different authors, it is the *ſpiritus mineralis* of Hoffman, the *aerial acid* of Berghman, the *ereſtatious acid* of Fourcroy, the *fixed air* of Prieſtly and Black, and the *carbonic acid gas* of the French chymiſts.

traction for lime than the aerial acid, would diſplace, and ſet it at liberty to be diſſipated in the form of air.

Of the Nature of the Water.

THE appearance of the ſalt water when viewed in a glaſs, is nearly tranſparent and colourleſs, though not perfectly ſo; for when compared with common pure water, it appears to have a perceptible bluiſh tinge, probably owing to its greater denſity. When poured from one glaſs into another, it has ſomewhat of an oily aſpect, being ſimilar to the vitriolic (ſulphuric) acid, which latter from this peculiarity has been improperly denominated an oil. The water taken pure from the ſprings, is deſtitute of any odor. Its taſte is extremely ſalt, and leaves a very ſlight bitter impreſſion upon the tongue; but it is much leſs nauſeous than ſea-water. If it be true, as Profeſſor Berghman ſuppoſes, that the peculiar nauſeous taſte of ſea-water, which is often attended with vomiting, and which is not found at all, or but very little in water taken up at the debth of ſixty fathoms, is produced by the putrefaction of the immenſe number of fiſh, worms, inſects and vegetables that grow, live and periſh in the ſea, and quickly putrefy on the ſurface, by expoſition to the air, aſſiſted by the ſaltneſs of the water; then it is evident that the water of the ſprings muſt be entirely deſtitute of it; for it iſſues clear and pure immediately from the earth, and is of itſelf ſufficiently ſtrong to prevent putrefaction.

The temperature of the different ſprings, which I examined by an accurate thermometer of Farenheit's ſcale, was from fifty to fifty-three degrees, as will appear more particularly from the ſubſequent table of ſpecific gravities of the different ſprings to which their temperatures are ſeverally annexed. This is the uſual heat of moſt ſprings of every kind, and hence has been deduced the interior temperature

of our earth, which is ſuppoſed to be uniformly and invariably the ſame, except where it may be altered by local cauſes. But it ought to be remembered that the temperature of the waters iſſuing from the bowels of the earth, may be conſiderably influenced by the ſuperficial acquired heat of its ſurface as they approach towards it, particularly in the ſummer ſeaſon; and hence the true internal temperature is probably ſome degrees colder.*

The ſpecific gravity of the water of a number of diſtinct ſprings was aſcertained by a hydroſtatic balance conſtructed with mathematical accuracy and ſenſible to the leaſt variation in the weight of the water, as exhibited in the following table.

* In the courſe of my tour through the weſtern part of the ſtate, I had frequent opportunities of examining the temperature of a variety of ſprings, favorably ſituated to aſcertain the interior heat of the earth as accurately as poſſible; the coldeſt which occurred to my obſervation was 47° (of Farenheit's ſcale.) The water of the ſpring in which this experiment was made iſſued immediately from the foot of a ridge of rocks about 150 feet high, nearly perpendicular; ſo that the temperature could have been influenced but very little (if at all) by the ſuperficial acquired heat of the earth's ſurface. I mention this more particularly, becauſe it may perhaps tend to correct ſome experiments made by Dr. Franklin upon the ſame ſubject: they were made I think in the waters of different wells, in and about Philadelphia, which he found to be 52°. This to be ſure is nearly the uſual temperature of ſprings and wells here, as well as in Philadelphia, and perhaps moſt parts of the world; but the ſtagnation of the water in which theſe experiments are uſually made, their expoſition for a length of time to the air, and other analogous circumſtances, would moſt probably raiſe the temperature very conſiderably. Without however making any allowance on this account, it has been taken for granted by philoſophers, and amongſt others by Darwin, that this was the real heat of the earth here; and comparing it with that of England, which is found to be 48° i. e. 4 degrees colder, they have puzzled themſelves to account for this ſuppoſed difference. Dr. Darwin, I think reſorts to the hypotheſis of internal fires, but the more probable idea is, that generally no ſuch difference exiſts; moſt of the ſprings which I examined were from 48 to 50 degrees.

A TABLE of the ſpecific Gravities and Temperatures of different Salt-Springs.

	Springs.	*Specific gravity.*	*Temperature.*
Standard rain water 1,000.	No. 1	1,110	51°
	2	1,078	51
	3	1,088	50
	4	1,107	51
	5	1,101	50
	6		
	7	1,100	52
	8	1,079	
	9	1,107	53
	10		
Mr. Geddis's		1,052	
Mr. Corey's		1,069	
Mr. O. Blennis's		1,045	
Mr. J. Danforth's		1,060	

The gravity of the water of Mr. Geddis's ſpring was aſcertained after a ſhower of rain, which perhaps diluted it a little. Mr. O. Blennis's and Danforth's being on the verge of the waters of the lake, appeared to be mixed with a portion of freſh water.*

It will be unneceſſary from the deſign of this eſſay to give a minute analyſis of the waters of theſe ſprings, and equally ſo to recount the experiments or deſcribe the proceſſes which were uſed to aſcertain their contents. It will be ſufficient barely to mention that I obtained from half a pint of this water 551 grs. or about 1¼ oz. avoirdupoiſe, of ſalt, and 26 grs. of calcarious earth (lime;) equal to 8816 grs. or 20 oz. and 76 grs. of ſalt to the gallon, and 416 grs. or nearly 1 oz. of calcarious earth. It contains alſo a very minute portion of vitriolic (ſulphuric) acid, probably united with the foſſil alkali in

* The quantity of impregnation of the water of theſe ſprings or any other ſalt water, may be aſcertained with tolerable accuracy, merely by comparing their ſpecific gravities with the known ſpecific gravity of water holding in ſolution definite proportions of common

the form of Glauber's ſalt (ſulphat of ſoda ;) but it is not impregnated with any iron as might be ſuppoſed from the colour which it imparts to ſubſtances with which it comes in contact ; for neither the Pruſſian alkali nor the tincture of galls produce any change when mixed with the water, both being accurate teſts to diſcover the ſmalleſt quantity of this metal. From the foregoing analyſis it appears that the proportion of ſalt held in ſolution by the water of theſe ſprings amounts to more than 1-6 of its own weight: this far exceeds every ſalt ſpring that we have ever heard of, and ſea water I believe, uſually contains no more than about 1-30.

With reſpect to the origin of the ſalt water we have nothing but conjecture. It is very probable, however, that it proceeds from a ſolid body of ſalt, at no great diſtance from the place where it iſſues

ſalt, as ſhewn in the following table, which I believe is nearly accurate being the reſult of a number of repeated experiments.

A TABLE of the ſpecific Gravities of Salt-Water, made by diſſolving decimal parts of an ounce of Salt, in half a pint of Water, correſponding to pounds, and their parts of Salt to a gallon of Water.

Decimal parts of 1oz. to the half pint or lb to the gallon.	Specific gravity.	Decimal parts of 1oz. to the half pint or lb to the gallon.	Specific gravity.
0,05	1,006	1,4	1,112
0,1	1,011	1,5	1,119
0,2	1,020	1,6	1,126
0,25	1,029	1,7	1,133
0,4	1,037	1,8	1,140
0,5	1,045	1,9	1,147
0,6	1,053	2,	1,158
0,7	1,061	2,1	1,159
0,8	1,069	2,2	1,165
0,9	1,077	2,3	1,171
1,	1,084	2,4	1,177
1,1	1,091	2,5	1,183
1,2	1,098	3,	1,209
1,3	1,105		

from the earth; or elſe it would be difficult to conceive how it becomes ſo ſtrongly impregnated, almoſt to ſaturation. The rocky bottom of the ſprings and the apparent guſhing of the water through its apertures, affords a preſumption that the body of ſalt may be immediately below, covered only by a ſtratum of calcarious rock; for ſalt mines are moſt frequently found covered and interſperſed with layers of lime-ſtone. At the diſtance of about half a mile from the ſalt point, there is a pit lately ſunk in the earth; it is four or five feet wide, deſcends twenty feet perpendicularly, and then appears to take an oblique direction downwards. This is ſuppoſed by ſome to have been cauſed by a vacuity underneath, produced by the diſſolution of a body of ſalt in the waters which lead to the ſprings. If it had any communication with them, I ſuppoſed there would iſſue from it an air of the ſame nature. To aſcertain this, I let down a burning candle into the pit, but it continued to burn without any diminution of its luſtre, a ſufficient proof that it contained none of the fixed air which the ſprings emit in ſuch abundance.

Of the Salt Manufactories.

THE marſh from which the principal ſprings proceed, is bounded, as I have before obſerved, by a ſteep bank of clayey ground, about thirty or forty feet above the level of the lake, forming the up-land on which the village of Salina ſtands. From this there is a gradual aſcent for a conſiderable diſtance back, commanding a beautiful proſpect of nearly the whole lake. The ſoil is clay, deſtitute of ſtones, and for the moſt part oak timbered. Immediately below the declivity, on the borders of the marſh, and as near the ſprings as the ground will admit, are ſituated the buildings which are deſtined for the manufacturing of ſalt. They are conſtructed of wood, generally about twenty feet wide, and of various

lengths, according to the number of furnaces they are intended to contain; in one of them there are forty evaporating pots. The furnaces are placed along one ſide of the building, with their mouths opening into it. The other ſide is generally made uſe of to depoſit the ſalt for the purpoſe of draining off the brine, and allowing it to dry, immediately after it is emptied out of the evaporating veſſels. The furnaces are built of ſtone, and two or three pots or kettles (ſuch as are uſed to boil pot-aſh) containing each about eighty gallons, are uſually placed over each of them. Between each two furnaces a large trough is placed, from which the water is drawn into the boilers as often as it is required. Theſe troughs are kept continually filled with water by means of gutters, into which it is pumped out of the ſprings. The furnaces being ſupplied with fuel, and the pots filled with water, they are allowed to boil briſkly, and after a little while the powder ſcratch (as it is called) conſiſting of calcareous earth, begins to precipitate to the bottom; this is taken out as faſt as it is formed, by means of large iron ladles. By the time this has all fallen down, the ſalt begins to chryſtalize; the pots are then ſuffered to boil gently, till nearly all the water is diſſipated. The ſalt is afterwards taken out and depoſited in proper places to drain off the brine and ſuffer it to dry. Nothing now remains in the pot but a ſmall quantity of bittern, which is thrown away, and the ſame proceſs is repeated. Part of the calcareous matter which is precipitated in the operation of boiling, adheres firmly to the bottom of the kettles, and becomes nearly as hard as ſtone, hence it is called ſtone ſcratch. It is neceſſary to ſeparate this every few days, by means of a ſharp iron pick; for if ſuffered to remain too long, it becomes ſo thick as to retard the boiling. Thus ſimple is the whole proceſs which is uſed in manufacturing a beautiful white granulated ſalt from the water of theſe valuable

ſprings. Each boiling of a ninety gallon pot, yields about a buſhel and a peck of ſalt; but there are many in uſe of a much ſmaller ſize; they may therefore be allowed on an average to make one buſhel each by every boiling; they may be boiled down two or three times in twenty-four hours. The whole number which have lately been employed in the different manufactories, is one hundred and fifty-ſeven; with theſe of courſe about 70,000 buſhels of ſalt may be manufactured yearly. From the report of the ſuperintendant to the legiſlature, it appears that "the quantity of ſalt made, ſold and delivered "from the 20th day of June, 1797, to the 3d day of "February, 1798, being ſix months and fourteen "days, (in which period of time is included the "ſickly ſeaſon of ſaid place) being manufactured in "one hundred and fifty-ſeven kettles of different "ſizes, is 25,474 buſhels." From the above ſtatement he calculates that "the probable proceeds of "all the kettles now occupied at the different ſalt-"works may be eſtimated at about 60,000 buſhels of "of ſalt per year."*

By reaſon of the immediate mixing of the waters of the ſalt ſprings with the waters of the marſh, it was impoſſible to make any computation of the quantity which they yield, or the amount of ſalt that may be made from them; but it muſt be very great; for one of the ſprings alone, judging from the ſtream which it emits, it is ſuppoſed could ſcarcely be lowered by the operation of an ordinary pump. Of many of the ſprings now uſed by the manufacturers, but a ſmall part of the water is conſumed; beſides a great many others that remain unoccupied: and it may be preſumed that many more will be diſcovered from time to time. This abundant quantity of the wa-

* Sixty thouſand buſhels of ſalt made annually, at the rate of four cents per buſhel, (the duty impoſed by law) will afford a revenue to the ſtate of 2,400 dollars; this will increaſe in time, with the increaſe of the manufactories, to a very handſome ſum. The price of ſalt is regulated not to exceed ſixty cents for a buſhel.

ter will permit a very great increaſe of the manufactories, and a production of ſalt to an immenſe amount.

We come now to examine whether the preſent method of manufacturing ſalt admits of IMPROVEMENT, and whether other means might not be deviſed, that would be attended with ſuperior advantage. But this important branch of the ſubject cannot be fully diſcuſſed within the limits of this memoir: I have perhaps already treſpaſſed upon the time of the ſociety; it muſt therefore be left at preſent in a great meaſure to the ingenious manufacturers, who are more immediately intereſted. To them it is recommended as a ſubject well worth their greateſt attention. They will doubtleſs ſtrive to obtain every information reſpecting the various methods and different inſtruments that have been uſed from time to time in foreign countries, where this article has been manufactured. They will likewiſe enjoy all the advantage to be derived from their own experience; and it is eſpecially by information and experience that manufactures and arts of every kind can be brought to the greateſt perfection. I ſhall take the liberty, however, to ſuggeſt only one or two improvements, which now occur to me as of primary importance. The firſt is, to ſubſtitute large flat pans in the place of the pots which are now altogether uſed. The moſt approved pans of this kind employed in foreign manufactories, a model of which I have now before me, are made of an oblong form, flat at the bottom, with the ſides erected at right angles; the length of ſome of them are 15 feet, the breadth 12, and the depth 16 inches. They are commonly made of plates of ſheet-iron, about one-third of an inch thick, joined together with nails, and the joints are filled with a ſtrong cement. A pan of theſe dimenſions will contain more than 1,400 gallons, and 4,200 gallons of water may be evaporated in 24 hours, which would produce at leaſt 60 buſhels of

ſalt. It is probable that it would require no more fuel for this purpoſe, than is required to boil down ſix of the pots now uſed, which yield only about 12 buſhels.

Another improvement which would probably be attended with great advantage, is the erecting partition walls between the openings of the furnaces and the boilers, by theſe means the duſt and aſhes, which is continually diſperſed through the air from the flues of the furnaces, would be prevented from falling into the water, and impairing the beauty and quality of the ſalt. Very little attention is given to this circumſtance, as the works are conducted at preſent: not only the boilers are continually expoſed to impurities, but the ſalt alſo after it is manufactured is frequently left in the ſame rooms with the furnaces, and by theſe means becomes almoſt covered with aſhes before it is taken away.

I might mention ſeveral other things tending to facilitate and improve the operation of extracting ſalt from the water of theſe ſprings; but they will readily occur upon a little reflection, to thoſe who are engaged in the works.

Notwithſtanding, however, all the improvements which can be ſuggeſted, and the inventions that can be had recourſe to, theſe manufactories will ſtill be attended with conſiderable labor and expence, and probably will become more ſo in courſe of time, with the ſcarcity of wood for fuel. At preſent the ſalt is afforded for ſixty cents per buſhel, with ample profit; but it is not to be expected that this will be of long duration, for the increaſing diſtance of carrying the wood to ſupply the furnaces, will proportionally increaſe the expence of manufacturing, and of courſe the price of the ſalt. At ſome future time neceſſity will perhaps compel us to reſort to ſome other means of evaporating the water, without the aid of fire. But before this period arrives, the hardy ſons of induſtry may poſſibly penetrate into the bowels of the

earth, and poſſeſs themſelves of that ſolid body of ſalt which is buried beneath: and who knows but there may be concealed ſuch an immenſe mine of this valuable article, that in proceſs of time, when a large portion of it ſhall have been conſumed, there may be ſufficient room (like in the ſalt mines of Cracow in Poland) for a ſubterranean "town, with a market "place, a church, a river, and a famous ſtatue," ſo beautifully deſcribed by the poetic Darwin.

> "Thus cavern'd round in CRACOWS mighty mines,
> With chryſtal walls a gorgeous city ſhines;
> Scoop'd in the briny rock long ſtreets extend
> Their hoary courſe, and glittering domes aſcend;
> Down the bright ſteeps, emerging into day,
> Impetuous fountains burſt their headlong way,
> O'er milk-white vales in ivory channels ſpread,
> And wandering ſeek their ſubterraneous bed." &c.

Dr. Hutton in his theory of the earth, ſuppoſes, that theſe immenſe maſſes of rock ſalt may have been produced by the evaporation of ſea water, in the early ages of the world, by means of ſubterranean fires. Dr. Darwin ſeems to be of the ſame opinion, and obſerves that this idea is confirmed by a fact mentioned in M. Macquarts Eſſais ſur Mineralogie, who found a great quantity of foſſil ſhells principally bi-valves and madre-pores in the ſalt mines of Wialiczka, near Cracow. If we apply this theory to the objects under conſideration, we may naturally ſuppoſe that the large cavity in the earth now occupied by the waters of the Onondaga lake, on the borders of which the ſalt ſprings appear, has at ſome early period been the mouth of a tremendous volcanic eruption, producing by its intenſe heat a ſudden evaporation of a large quantity of ſea water, which it happened to meet in the interior parts of the earth. This idea, if admitted, will at once account for the formation of a lake, and the production of a ſalt mine; at the ſame time that it leads the mind with more facility to conceive of the probable magnitude

of the latter. Great indeed muſt be that body of ſalt, which we may ſuppoſe to be produced by a torrent of heat near ſix miles in diameter, volatizing and diſſipating the waters, and leaving the fixed and ſolid materials in accumulated heaps. Or is there ſome ſtill undiſcovered chymiſtry of nature, that elaborates ſalt from the materials of this earth, and collects it in ſuch huge maſſes as to be proof againſt the waſtes and depredations of time. For in whatever way it may be produced our idea of the quantity remains undiminiſhed, when we conſider that it has probably for ages ſince, impregnated the copious ſtreams that flow from theſe ſprings, almoſt to complete ſaturation.

Result of Thermometrical Observations for the years 1795 and 1796, made at the City of Albany;

By SIMEON DE WITT.

1795	Mean deg. of the coldest time of the days, A. M.	Mean deg. of the warmest time of the days, P. M.	Mean degree of the month.	Greatest cold in the month.		Greatest heat in the month.	
January	18°	31°	24°½	14th day	6° below o	4th day	45°
February	23	31	27	27	10 below	4	46
March	33	41	37	9	20 above	25	66
April	43	56	49½	10	26	5	80
May	53	71	62	1	35	8	85
June	53	75	64	14	51	19	90
July	65	84	74½	8	54	12	96
August	66	83	74½	22	49	7	94
September	56	70	63	24	43	15	91
October	43	60	51½	27	25	4	77
November	32	43	37½	28	18	7	65
December	29	39	34	23	11	13	50
Mean temperature of the whole year							50°
Greatest variation between the extremes of heat and cold							106
1796							
January	19	32	25½	31st day	10 below o	3d day	49
February	17	33	25	5	4 below	27	47
March	24	38	31	20	4°	23	55
April	36	59	47½	6	24	22	84
May	48	65	56½	3	32	27	77
June	56	81	68½	3	45	25	91
July	61	84	72½	1	54	27	92
August	58	79	68½	31	41	28	94
September	50	74	62	24	37	11	86
October	36	60	48	11	27	13	66
November	—	—	—	28	13	—	—
December	18	22	20	24	20 below	16	32
Mean temperature of the whole year							48°
Greatest variation between the extremes of heat and cold							114

The observations of which the preceding table is the result, were made from the state of the thermometer at its two extremes within each 24 hours. It is only in this manner that the true mean of the weather can be obtained. I do not know for what rea-

ſon obſervers have fixed on 8 o'clock in the morning and 2 in the afternoon, as is uſually done, for noticing the ſtate of the thermometer. From ſuch obſervations no true compariſon of climates, which is their principal uſe, can be made. It is therefore to be wiſhed that all obſervations in America, could be made on the principal I have adopted: we might then obtain a juſt comparative view of the weather in all places where accounts of it have been kept. It is ſomewhat remarkable that the mean temperature of the weather with us, is almoſt exactly that of the coldeſt ſpring-water, or the temperature of the bowels of the earth.

RESULT *of* THERMOMETRICAL OBSERVATIONS *for the year* 1797, *made at the city of New-York;*

By GARDNER BAKER.

1797.	Mean degrees at 7, A. M.	Mean degrees at 3, P. M.	Mean degree of the month.	Greateſt cold in the month.		Greateſt heat in the month.	
January	24	33°	28°½	9th day	0°	28th day	46°
February	32	41	36½	26	16	24	57
March	34½	44	39	7	19	18	62
April	43	53	48	10	36	29	71
May	52	63	57	3	42	11	75
June	61	75	68	1	50	30	89
July	70	82	76	5	64	21	90
Auguſt	67	78	72½	15	56	24	82
September	59	71	65	20	51	2	87
October	47	57	52	30	34	8	77
November	35	42	38½	18	17	3	66
December	23	30	26½	28	1	13	44

Mean temperature of the whole year 49°½

Greateſt variation between the extremes of heat and cold 90

Thermometrical Obſervations, made on the North-Weſtern Lakes, from Auguſt 4, *to September* 4, 1797. *By* Major C. SWAN, *Paymaſter to the Weſtern Army.*

[From the Medical Repoſitory.]

1797	6 o'clock A. M.	12 o'clock M.	7 o'clock P. M.	Average	Remarks where.
Aug. 4	66	63½	59	62¼	Lake Sinclair.
5	59	66	63½	62¼	do.
6	55½	65	66	62	River Sinclair.
7	60	67	67	64	do.
8	59	61	61	60	do.
9	57	62	52	57	do.
10	58	62	61	60	do.
11	63	59½	60	60	Lake Huron.
12	57	60	61	59	do.
13	55	55½	55	55	do.
14	50	49	47	48	do.
15	45	66	54	55	Michilimackinac.
16	52	70	53	58	do.
17	54	69	60	61	do.
18	52	67	62	60	do.
19	54	64	56	58	do.
20	53	64	58	58	do.
21	62	63	63	62	do.
22	54	61	59	58	Streights of St. Joſeph.
23	57	65	60½	62	do.
24	50	63	60½	57	do.
25	46	53	49	49	Falls of St. Marie.
26	46	49	50	48	Lake Superior.
27	50	56	49	51	Streights of St. Joſeph.
28	40	50	46	45	Lake Huron.
29	51	54	57	54	do.
30	49	57	53	53	do.
31	50	56	49	51	do.
Sept. 1	48	57	47	50	do.
2	51	59	50	53	do.
3	49	58	50	52	Rivet Sinclair.
4	48	56	49	51	Lake Sinclair.

PART IV.

TRANSACTIONS, &c.

Addreſs delivered before the Society, in the Aſſembly-Chamber in the City-Hall, in the City of Albany, February 20, 1799;

By SIMEON DE WITT, *Surveyor-General.*

Mr. Preſident, and Gentlemen of the Society,

AGRICULTURE, ARTS, and MANUFACTURES, for the promotion of which this ſociety is inſtituted and to which it is the duty of each of its members to adminiſter, are objects claiming a regard of the higheſt nature from every man to whom the happineſs of his fellow-creatures can communicate reciprocal impreſſions of pleaſure. As a member of ſuch a ſociety, I confeſs I feel the weight of a duty on me not to be ſlighted or neglected without incurring the juſt charges of criminating reflections. The force of ſuch ſentiments has prevailed on me to undertake the taſk of making the annual addreſs to you at this time, in obedience to your order, and agreeably to a cuſtom, which on account of its good tendency, I cannot but approve. While ſuch are

my motives, I have reaſons to hope that you will be indulgent to my failings.

The deſign of the ſociety in appointing annual addreſſes ſeems to have been to give occaſional opportunities to ſome of its members to ſuggeſt matters that may facilitate its operations for the more effectual attainment of its ends. Conformably to this idea, I ſhall undertake at preſent to bring into view what I conceive neceſſary to be attended to in order to promote the uſefulneſs of the inſtitution, together with the duties of thoſe who have aſſociated under it. I am ſorry that from ſuch ſubjects I can promiſe you but little entertainment, as I ſhall have to ſtudy plain inveſtigation, rather than a brilliant diſplay of ideas. There is the greater neceſſity for my beſpeaking every favorable allowance from you, ſince the part I am now to act has been performed heretofore by gentlemen who ſtand on the liſt of ſcience and eloquence as well as the honors of their country in the moſt conſpicuous rank.

Our buſineſs generally is to collect all the improvements within our reach that may be made in agriculture, in manufactures and in the arts of whatſoever kind they may be. But the firſt of theſe in a more eſpecial manner is our object, and to this I ſhall chiefly confine my remarks. The maſs of materials thus collected require of us moreover, before their utility can become effectual, that they be digeſted and arranged in ſuch manner as that every change or innovation propoſed in the practice of huſbandry, and approbated by the ſociety, may appear ſo obvious and unqueſtionably beneficial, that no one ſhall have occaſion to ſcruple its eligibility, or heſitate to adopt it. It is incumbent on us alſo to ſketch out plans of experiments neceſſary to verify facts, or try the truth of theories, and without depending on the gratuitous labors of others, to cauſe ſuch plans to be executed under the authority and immediate direction of the ſociety.

In proſecuting ſuch a work the firſt inquiry will neceſſarily be concerning thoſe particulars apparently the moſt capable of improvement, and at the ſame time of ſuch importance as to demand ſpecial attention. Theſe may be noted as follows: 1ſt. Manures. 2d. Preparations of the earth for the reception of ſeeds by mellowing the ſoil. 3d. Rotations of crops. 4th. The different kinds of grain, fruit and cattle, to which may be added hedges and fences. What may be done for the improvement of each of theſe will employ a few curſory remarks.

Before I proceed, however, it will not be amiſs to premiſe that moſt of the improvements we can propoſe to ourſelves muſt be with an eye to economy, that is, to the means of obtaining the moſt with the leaſt labor or expenſe; and this muſt be teſted by ſound calculations.

1ſt. On the ſubject of *manures*, ſeveral valuable communications have been made; but the farmer is yet uninformed by us what additional quantities of produce he may expect in return for given quantities of each ſpecies of manure recommended to him; when he is once made acquainted with this, and knows for a certainty what profits he will receive from following our preſcriptions, there is no reaſon to doubt that he will liſten to our advice; but until the advantages promiſed to him are ſtated ſo as to carry conviction to his mind, we cannot expect that he will abandon his old practice for the ſake of novelties, the conſequences of which he cannot foreſee. To this point then our proofs ſhould be directed and the proper inferences made; for no diſcovery can be accepted as valuable, unleſs its advantages be made ſtrikingly manifeſt. Little benefit can be expected from a looſe, unſyſtemiſed aſſemblage of experiments; few will take the pains, and many good practical farmers are not competent to make the compariſons and calculations requiſite to determine the eligibility of what is propoſed. In order to enſure the adoption

of any thing held out to the people at large, let it be remembered that plainneſs, ſimplicity and conciſeneſs of argument and demonſtration are of eſſential importance; it is not ſufficient merely to ſtate the propoſitions of a ſyllogiſm, we muſt alſo draw the concluſion.

I believe *compoſts* have not hitherto been placed in ſuch an obvious light as to attract that regard to which their intrinſic worth juſtly entitles them. Many old farms of indifferent ſoils, or exhauſted by cultivation, remain in their impoveriſhed ſtate, and their owners in diſpair of bettering them, ſit down under the conviction that they cannot yield a ſufficiency of manure to fertilize them to a higher degree. Compoſts they conſider only as collections of manures, when in fact they are properly ſpeaking *manufactories* of them. By abſorbing from the air the fertilizing principle, or brewing it by means of a ſpontaneous fermentation, heaps of compoſts acquire or generate accumulations of that which barren earths want to capacitate them for the production of vegetables, thus creating out of mere inert matter, maſſes highly charged with the moſt active qualities for ſuch a work. Of this our countrymen require proofs, and it is our buſineſs to give them. We are to convince them that materials with which every farm how poor ſoever, abounds, or which lie withing its reach, and which in their ordinary ſtate can but ſlightly contribute to fertilization, may by a proceſs ſimple and without much labor, be manufactured into plentiful ſupplies of the richeſt manures.

2dly. On the *preparations of fields for the reception of the ſeeds*, by mellowing and pulverizing the ſoil, and opening its boſom to the genial influences of the ſkies, I ſhall ſay but little; the only queſtion of note that can be raiſed on this head is, to what extent may labor be beſtowed in this way moſt profitably? Whether any plowing or harrowing in addition to what is uſually done, would make ſuch ad-

ditions to the produce as to overpay the expenſe? Is not this a matter deſerving ſome inveſtigation? Any concluſions that may have been drawn on this ſubject in Europe are very inapplicable to this country; there land is dear and labor is cheap, here the caſe is exactly the reverſe; our calculations on this and many other branches of agriculture, muſt therefore be made on principles widely different. To beſtow on a field deſigned for wheat as much labor of this kind as we would on a garden, would certainly not be economical; on the other hand, to be too ſaving of labor would be equally bad management: there is *a point* between theſe two extremes which will give the moſt profit, and it is the buſineſs of this ſociety to determine it as far as is practicable.

3dly. The next article I mentioned, was *rotations of crops*. It is an obſervation univerſally known, that the ground on which flax has been raiſed, is not fit for the ſame uſe till after an interval of ſeveral years. With the phyſical cauſe of this phenomenon we are yet unacquainted, and perhaps will remain ſo forever. But although the arcana of nature lie far beyond our comprehenſion, we may profit by attending to her operations; and we are allowed to frame theories, although demonſtrations of their correſpondence with realities ſurpaſs our capacities. I ſhall therefore venture to make a gueſs at the cauſe of the fact juſt mentioned.

I will ſuppoſe that there are as many diſtinct principles or combinations of principles, engaged as agents in the work of vegetation, as there are ſpecies and varieties of vegetables; that theſe have their reſidence in the atmoſphere, and are capable of being abſorbed, changed and regenerated by the earth eſpecially when by the labors of the huſbandman it is bared and expoſed to their influence. I will next ſuppoſe that generally an equal quantity of theſe are imbibed and ready to adminiſter to the rearing of any correſpondent vegetable;

whoſe ſeed may be depoſited in ſuch earth. If then only one kind of ſeed be ſown on a given quantity of ground, it will exhauſt that particular principle which nature has provided for its growth. This ground will then become unqualified for the raiſing of a ſimilar crop, until time be given to the ſoil again to abſorb from the air that principle which has been thus diminiſhed in the quantity, which the ſoil has a tendency to receive, and the capacity to hold: in the mean time any other vegetable will there find its appropriate principle undiminiſhed and ready to do its offices in raiſing it to maturity. Philoſophers may ſay that they have already analyzed our atmoſphere and aſcertained its conſtituent parts; but let me aſk the queſtion, if they are certain that each of theſe parts are not capable of further analyzation, perhaps *ad infinitum*, and if they can fix the *ne plus ultra* of nature's refinements, and ſay where ends the laſt ſubdiviſion of her works! If not then this theory cannot be condemned for want of plauſibility. What has been obſerved of flax is ſuppoſed to be true in ſome degree at leaſt as to moſt other cultivated annuals. Beſides it is further ſuppoſed, I may ſay it is proved that a crop of one kind ſo far from unfitting, will rather qualify the earth the better for the production of another, if the ſucceſſion be conducted as experience directs.

If this theory then be admitted to be well founded, the advantages of rotations of crops can be ſufficiently proved *a priori*; but there is no need of depending on perſuaſives of this kind; the experience of Europe, where neceſſity more eminently than in this country, has become the mother of invention, has proved to the full conviction of all its practical farmers, that this is to be numbered among the beſt of modern improvements. A difference of climate and of other circumſtances does not preſent objections to our following them in this, that is does in other reſpects. I wiſh therefore to ſee my coun-

trymen obſerving their rules in this particular with more exactitude. Theirs is certainly the greater experience, and where ſpecial reaſons do not forbid our imitating them we ought to do it, at the ſame time that we reſerve to ourſelves the right of purſuing our experiments in the wider field that lies before us, with the ambition of Americans, reſolved to outdo all other nations in the rapidity and acceſſions of our improvements. The directions reſpecting rotations of corps, contained in books already extant, are at preſent the beſt guides for us.

4thly. In the fourth diviſion of the branches of agriculture held out as capable of improvement, and meriting our regard, we mentioned *grain*, *fruit* and *cattle*. That certain ſpecies of the productions of the earth may be improved as well as degenerate, experience and obſervation ſatisfactorily ſhew us. Wheat, rye, barley, oats and maiſe, or Indian corn, are here moſtly entitled to our attention: can we improve the qualities of either of theſe? that we can is perhaps not an abſolute certainty, but while there is a probability let us not loſe ſight of it. If we reaſon from analogy, there is no cauſe of deſpair; and if it can be done the value of the acquiſition will be incalculable. I ſhall here make a remark, which if true, will be granted to be of ſome importance. It ſeems to be one of the laws of nature, that ſpecific changes in vegetables as well as animals can be effected; but only by a ſlow and gradual progreſs. What at firſt is a mere accidental property and not ſenſibly inheritable, may by a repetition of impreſſions from generation to generation, become at laſt confirmedly hereditary. That this is the caſe with regard to animals, many occurrences prove. Indeed we cannot in any other way rationally account for the varieties even of our own ſpecies, diſtinguiſhed by colour, ſize and other peculiarities, obſerved in nations, tribes and families. No one will pretend to ſay that ſuch diſtinctions were brought about in a

day or a year: they muſt therefore be produced as has been aſſerted, by the continual and uniform action of their cauſes. The properties impreſſed on one generation being thus inherited in ſome degree by the next, which receiving additional and ſtronger impreſſions of the ſame kind from the ſame cauſe ſtill operating, will tranſmit them ſtill further with increaſed efficacy, till at laſt the effect is carried to its ultimate point.

Such conſiderations will ſuggeſt to us the means of improving our varieties of grain. If they poſſeſs like animals the faculty of inheriting qualities, of which there is little doubt, we ſhould from year to year ſelect the beſt for propagators, and from their produce again chuſe the beſt, and thus continue without intermiſſion. By ſuch means purſued for a length of time, it is more than probable we would accompliſh the deſired object; and who knows to what degree of perfection ſuch things may be carried by unremitted application and care. The middle ſtates of the Union, of which New-York may be ſelected as the chief, are without queſtion not exceeded by any on the ſurface of the globe, as a country favourable to the raiſing of wheat. We have therefore nothing to apprehend from ſoil and climate, in oppoſition to our endeavors to bring it to the higheſt degree of perfection of which it is capable, and this being the moſt valuable production of the earth, we ſhould ſpare no pains to improve it to the utmoſt poſſible pitch.

Fruit, by which I mean what the word ſignifies in its moſt common or limited ſenſe, may be improved chiefly by making ſelections of the beſt kinds that occur, and preſerving them by grafting, inoculation and other well known methods of obtaining the qualities of the parent vegetable undegenerated, if not meliorated, in its progeny. What valuable acquiſitions lie within the range of poſſibilities, if we pay due attention to this article may be aptly illuſ-

trated by ſimply pointing to recent occurrences. The Spitſenbergh apple, which may challenge the world to match it, was firſt diſcovered as an accidental production, in the neighborhood of this city; fortunately it fell into the hands of a man of taſte, who made its ſuperlative excellencies known to others, and gave perpetuity to its kind; but for this accident it muſt again have retreated into eternal oblivion. Its compeer, the Newtown pippin, though not ſo exquiſitely high flavored, yet perhaps ſuperior in its ambroſial delicacy, is of ſo late an origin, that facts relative to the place and manner of its birth are not yet obſcured by the length and uncertainty of tradition. Other kinds, ſprung from American ſoil, and even from this ſtate, need not ſhrink from a compariſon with the beſt that Europe can offer. Among the infinite varieties of fruit which the ſeed of the apple produces, how many that would enrich the choiceſt catalogue, muſt periſh for ever with the limbs that ſupport them, merely for want of notice! It cannot therefore be improper to recommend to the members of this ſociety to be obſervant of what nature does: ſhe like an indulgent mother holds out to us her favors in every varied ſhape, as if intent on gratifying every eccentric whim, as well as all the innate appetites of her children, however innumerably diverſified they may be; mixed with her coarſer works frequently a jewel is to be found. Let us not then through mere inattention loſe ſuch invaluable prizes when thus gratuitouſly offered to us.

The obſervations here made on the apple, may with proper exceptions be applied to pears, peaches, plumps, grapes, gooſberies and many other kinds of fruit, collections of which in their higheſt ſtate of perfection are capable of regaling the palate with all the luxuries of a paradiſe.

That the breed of cattle may be improved. The manner in which this may be effected, and the im-

menſe advantages of it are ſo well known and have become topics ſo familiar to every one, that it would ſeem quite ſuperfluous to mention them on ſuch an occaſion as this. I ſhall therefore leave them untouched excepting in one or two points of view that may not be ſo very common. There are peculiar conformations of animals beſt adapted to certain purpoſes; what theſe are can only be known by cloſe and accurate obſervations. By ſuch obſervations it has been diſcovered what corporeal properties in ſheep indicate the beſt diſpoſitions to bear the fineſt and largeſt fleeces of wool, and by ſeparating from ordinary flocks ſheep poſſeſſing ſuch properties for breeders, and continuing the practice, we have ſeen to what an aſtoniſhing pitch of improvement they have been brought in ſome European countries, even under diſadvantages to which our climate is a ſtranger.

By the ſame attentions I therefore take it for granted that the breed of other cattle may be proved with an eye to certain ſpecified purpoſes. It may ſeem fantaſtical, but there is no ſubſtantial reaſons to believe it impoſſible, that we might in the ſame manner procure at pleaſure a comparatively dwarfiſh or gigantic race of animals, were it an object worthy to be attempted. There are however limits or barriers planted by nature on each ſide, beyond which, variations from her general ſtandard are not permitted to go; on which alſo climate and other peculiar adaptations of circumſtances have a governing influence. But it is as certain that there is a range, within which means adapted to their ends may effect viſible changes in the conſtitutions and aſpects of animals, and by ſkilful management may be made to anſwer certain ends propoſed to be attained. We ought therefore to examine with the niceſt ſcrutiny what particular conformations are beſt fitted for the uſes intended to be made of domeſtic animals, and in the manner already ſuggeſted, to eſtabliſh breeds

of them in which ſuch properties ſhall be improved and made permanently hereditary. Among horned cattle for inſtance, thoſe of an athletic make, though well calculated for draft, are not the beſt for milk; thoſe two kinds ought therefore to be ſeparately reared as families diſtinct from each other. In what other reſpect ſimilar diſtinctions might be uſefully made, I ſhall leave to the reflections of the ſociety.

It cannot be amiſs here to mention the propriety of domeſticating ſome of our wild animals, and aſcertaining the degree of uſefulneſs that may be derived from this ſource. The elk, the mooſe, and biſon, improperly called the buffaloe, preſent themſelves as fit ſubjects for ſuch experiments. Of the firſt of theſe our preſident, ever indefatigable in uſeful purſuits, has commenced the trial, and it promiſes fair to terminate ſucceſsfully. The mooſe alſo by his gigantic ſize, by his ſtrength and agility, by his qualities to furniſh us with labor and food, as alſo by his defenceleſs condition and danger of total extinction, ſeems to plead for admiſſion into the ſervice and protection of man. But let the obſervations already made be recollected, which if well founded, ſhould induce us not to relinquiſh ſuch endeavors till we have proved their ſucceſs by trials on ſeveral ſucceſſive generations of the ſame ſtock, and have thus effectually determined how far their nature is capable of being regenerated and ſubdued to the uſeful occupations and dominion of man.

5thly. On *hedges* and *fences* I ſhall only make one remark: we do not yet know in this country the comparitive merit of theſe. This ought to be aſcertained; when it is once reduced to the certainty of demonſtration, which mode of incloſing our fields will ultimately be the moſt ſaving, the country it is to be preſumed, will adopt it. Gentlemen of property and patriotiſm ought to conſider it their duty not only to make agricultural experiments, but to give us the firſt example of carrying into practice

what ſpeculative reaſoning and the experience of other countries recommend as proper to be introduced into our own, eſpecially in regard to the article under conſideration. The increaſing ſcarcity of timber makes this an object of no inconſiderable degree of importance, and the novelty of hedges among us, require that ſamples of them be exhibited by the patrons of rural economy.

Notwithſtanding all the perſuaſives that can be employed to excite gentlemen diſperſed through the ſtate, to bend their endeavors to the improvement of agriculture; notwithſtanding the confeſſed importance of the ſubject, and the general conſent that our wealth and greatneſs as a people muſt hence be derived; notwithſtanding it be acknowledged that here is a field without bounds for the diſplay of talents and taſte, and that incentives from the moſt amiable paſſions of the heart urge us to it; I fear that we will not find the deſign fully executed, if we wholly rely on the efforts of its ſcattered members. We have indeed no reaſon to doubt that their contributions to the fund of experiments, will be large and ſpirited, but they will be too hetorogenious, and not always ſuch as will ſerve completely to demonſtrate the facts moſt neceſſary to be proved. The only way by which we can ſyſtematically and effectually do our buſineſs, is by eſtabliſhing an EXPERIMENTAL AGRICULTURAL GARDEN. This to us will be the ſame thing that a labaratory is to the chymiſt; he with his apparatus in his room has diſſected earth, air and water, chaſed nature through all her intricate flights, and formerly deemed inſcrutable mazes, penetrated to her ſecret hiding places, explored her dark receſſes, unlocked her cabinets, rifled them of her richeſt jewels, and filled the treaſury of ſcience. What would he or could he have done if his dependence for information had been altogether or chiefly on the labours of others? It is to be preſumed that a cloud of darkneſs would yet enſhroud that moſt

uſeful and delightful of ſciences. In the ſame manner an agricultural garden properly conducted, might be made a little repreſentative, a miniature of the world, and furniſh in a ſhort ſpace of time, more facts relative to the hiſtory, nature, diſpoſition, conſtitution, laws, government and general economy of the republic of vegetables, than could by any practicable means be obtained from all America in a large portion of a century. Here exotics might be collected and naturalized, our wild, indigenous plants tamed, and their uſeful qualities inveſtigated, every mode of culture tried, and the beſt accurately aſcertained, experiments made of whatever promiſes fair in theory, or may lead to future diſcoveries and proofs of all theſe exhibited to the eye, ſo that no one ſhould have occaſion to riſk any thing by venturing on doubtful projects.

This ſtate it muſt be confeſſed does not unfold to the philoſophic world a much admired feature in the portrait of America. By what inſtitutions for the furtherance of uſeful knowledge, or by what extraordinary efforts of our citizens to advance the arts of peace, truly patriotic, have we diſtinguiſhed ourſelves? A univerſity, colleges and academies we have it is true; they ſerve to ſave us from the ſhame of not following the faſhion of nations. Nothing extraordinary can be placed to our credit on their account. What more have we to boaſt of? How few of our learned characters ſtep aſide for a moment from their profeſſional employments, to ſhew themſelves intereſted in diffuſing a taſte for uſeful philoſophy and works of ingenuity. Hiſtorians have always complimented emperors, kings, and the rulers of republics with the moſt delicate panegyrics for their patronage of the arts and ſciences, and indeed the teſt of time ſhews that ſuch praiſes were the beſt merited and the moſt worthily beſtowed. Macænas, although a renowned prime miniſter of one of the greateſt monarchs on earth, would never

have left behind him a name diſtinguiſhed as it is, immortalized by the fineſt writers that ever exiſted, and the ſweeteſt ſongs that were ever penned, had he not been the patron of genius. Even the pre-eminent political purity of that great man under whoſe auſpices we roſe as a nation, will not retain an unſullied whiteneſs under every hiſtorian's pen. The beſt of ſtateſmen and warriors have the bleſſings of their memories mixed with curſes; their deeds may aſtoniſh the world for a while, and their fame dazzle like the blaze of a meteor with a momentary glare, but the fathers, friends and guardians of uſeful arts have their untainted memories embalmed, and urn their aſhes in the hearts of poſterity. As long as time continues its current, their works and their names together float along with it, and are gratefully recognized by ages following ages without end.

The ſociety of which I now ſtand the repreſentative, is without queſtion the moſt conſequential in the ſtate: Which beſides it, receives any notice from abroad, or is calculated to excite it? Barren as our printed tranſactions may appear to the prejudiced eyes of thoſe who have not condeſcended to compare them with others, I will venture to affirm that they have as good a complexion, and are fully as intereſting as thoſe of a ſimilar kind, by which Europeans are climbing up to greatneſs, and aſcending the ladder of philoſophic fame. The only effort we can boaſt of to inſtitute any thing like this eſtabliſhment, was an attempt ſoon after the revolution, to erect ſomething like a philoſophical ſociety.—Science was thus in a ſhort lived fit of enthuſiaſm, propoſed to be courted by our ſplendid characters. She was oſtentatiouſly embraced for a moment with a meretricious rapture, and immediately after with mercileſs wantonneſs abandoned to her fate. Where is the ſolitary evidence in our favor of a permanent legitimate affection for her? The extinction of this

ſociety, therefore, if we can ſuppoſe it poſſible to be ſuffered to die, will be accompanied by the laſt gaſp of our reputation as a people conſidered in a ſcientific light, and with it all the hopes it has revived from their formerly ſunken ſtate will be buried *to riſe no more.* Excluſive of this we are totally deſtitute of the means of concentrating into a common reſervoir the progreſſively acquired knowledge of our citizens on the all important ſubjects we embrace, and many a happy diſcovery muſt be left like the flowers of the foreſt to periſh in uſeleſs obſcurity.

While millions heaped upon millions are expended to protect the intereſts of the ſmall proportion of Americans who have choſen navigation as a trade, certainly a little beſtowed or even thrown away with a good intent for the promotion of agriculture, cannot be deemed a miſapplication of money. So far from being conſidered as a partial bounty, it would go ſome way to obviate the too juſtly grounded imputation of an overſtrained bias in favor of commerce.

And what other inſtitution can there be conceived more deſerving the patronage of a legiſlature than this? Has it any thing for its object that does not directly aim at the happineſs of mankind? The leſſening of labor, that firſt curſe pronounced on man after his loſs of innocence, is its principal view. It aſpires to the procuring of every enjoyment which the earth preſented in the golden age, as ſung by poets in ſtrains the moſt enthuſiaſtic and ſublime. On ſuch ſubjects the good man's meditations delight to dwell. The Elyſium of Pagans, the Paradiſe of Mahomet, and perhaps alſo the Heaven of Chriſtians, would to the view of mortals, loſe much of their attractions, were not the deſcriptions of them decorated with agricultural ſceneries; indeed they almoſt neceſſarily mingle with our ideas of conſummate bliſs. While paſſions like demons tear the breaſt of the politician, gnaw like vultures on his

vitals, ſpread a gloom over his perſpectives and embitter his days, the heart of the philanthropiſt expands with a ſeraphic joy, bounds with godlike palpitations, and feels emotions of extacy ineffably exquiſite as his eye roves over fields where the golden harveſt luxuriantly waves to the wind; where every ſhrub and plant is loaded with dainties, where every tree bends under its fruit, and all things ſeem to invite us to partake of their bounties and be happy. If then theſe things are pure, uncontaminated fountains whence human happineſs flows, ſurely we cannot contemplate them with a ſtoical indifference; but as Citizens, as Chriſtians, and as Legiſlators, muſt join our endeavors to cheriſh and ſupport them.

ON CULTURE.

On Vetches (Vicia Sativa vulgaris) and the Benefit ariſing from the Cultivation of them as a Summer Fallowing Crop. By ROBERT R. LIVINGSTON, *L. L. D. Preſident of the Society.*

THE introduction of a plant unknown to our ſoil and climate, and its relative value here, and in countries in which it has long been naturalized, is always important to agriculture, either as it preſents the farmer a new object worthy his attention, or as it keeps him from entertaining falſe ideas of its value, and waſting his time and money upon one that will not repay his expenſe.

Having obſerved that vetches, or as they are ſometimes called, tares, were cultivated in Britain and in many other parts of Europe, either for ſeed or forage, I procured from England nine buſhels, ſix of which are called ſpring and three of winter vetches.

1ſt May, 1794. Ploughed a[illegible]roſs-ploughed one

acre of rye-ſtubble; the land a light loam inclining to ſand, upon a ſandy bottom, ſoil much worn out; the preceding crop ſummer rye. After harrowing fine, I ſowed three buſhels of ſpring vetches. When they were up, ſpread ſix buſhels of gypſum. About one fifth part of the field was on a declivity and very poor; here the crop was thin, yet low and ſhort, the reſt of the land was finely covered with a thick, cloſe crop. The vines matted in each other, inſomuch that the plants moulded at the bottom. When in full bloſſom they were cut, about the 20th Auguſt; they yielded two large waggon-loads of hay, which I compute at about 25 cwt. The provender appeared to me remarkably ſucculent, and extremely well calculated for cows and ſheep. Mine was applied to the uſe of the latter, but not having been at my farm ſince the winter ſet in, I can give no account of its application.

Second Experiment.

SOIL a looſe, ſlaty gravel, mixed with clay, being a dry hillock, containing one acre excluſive of ſome part in wood. In 1793, bore buckwheat; ploughed twice laſt April, and firſt of May ſowed three buſhels of vetches; ſtrewed over them when they made their appearance, ſix buſhels of gypſum. Theſe were deſigned for ſeed, but the ſummer proving wet they continued growing all through the ſeaſon, the ſeed at the bottom moulding and dropping out, while they bloſſomed at the top ſo that I could not tell when to cut them. They ſtood till October; when ſtretched out the plants were four and five feet long, but generally moulded below; when threſhed I only got from them three pecks of ſeed of a very indifferent quality.

Upon comparing theſe experiments with the uſual increaſe in England, it appeared to me that the quantity of forage obtained was not inferior to what a ſimilar ſoil would have produced there, and of courſe

that our climate is not unfavorable to the culture, provided we can render them more productive of ſeed; which I can hardly doubt. My error was, I believe, in ſowing them too thick, and manuring with gypſum, which makes every plant on which it operates, run to *haulm*. The wetneſs of the ſeaſon alſo contributed to this evil, which may I hope be corrected by a little more experience and care.

Upon this head, however, we are authoriſed to ſay little, but that this experiment has failed, ſo far as relates to the production of ſeed; but that the general health and vigor of the plant gives us reaſon to hope that future experiments may be more ſucceſsful. If this ſhould be the caſe, and we can with facility raiſe our own ſeed, (its common product in England being 25 or 30 buſhels to the acre) this plant will be extremely uſeful to thoſe farmers who want a competent proportion of meadow, and indeed in another point of view to every farmer.

If cut for forage it comes ſufficiently early to plough and ſow wheat, for which I ſhould think it the beſt of all preparations. The ground is ſo well covered that every weed is ſtifled: the air at the roots is ſtagnant, and the plant being of that ſucculent kind which feeds much upon the atmoſphere, I think it cannot fail to add to the fertility of the ſoil. Mine appeared ſo mellow and free from weeds when the vetches came off, that I was tempted to ſow the piece with lucerne, which looked very fine and promiſing when the winter ſet in.

Our Indian corn comes off too late for wheat, it is therefore uſual with us to fallow it with a ſummer crop of oats and a ſmall proportion of flax; this I believe to be bad huſbandry, as the corn is an exhauſting crop, ſo is oats, and in this way the ground is always growing worſe, and as it is ſeldom rich enough to bear wheat after oats, we generally ſummer fallow for wheat, which is rendered by that means a very expenſive crop. On the contrary, if

we followed our corn with vetches, we ſhould be able to put wheat in the ſame ground, and if clover is ſown over the wheat in the ſpring, and permitted to continue only two years, and then followed by corn, the labor of farming will be diminiſhed, and the fertility of the land increaſed by the double operation of theſe leguminous crops on the air, and in the quantity of manure that will be furniſhed by the additional ſtock they enable the farmer to keep. As this ſubject, ſo well underſtood in Europe, has hardly been attended to here, I will endeavor to ſtate the profit and loſs of two farmers, each cultivating (beſides their meadows) one hundred acres of arable land, one in the uſual mode of this country, and the other by the intervention of vetches and clover.

	Common agriculture 100 acres.	*Profit per acre.*
20	acres of Indian corn, 35 buſhels at 4s.	7 0 0
20	Oats on corn ground of the preceding year, 20 buſhels at 2s.	2 0 0
20	Summer fallow	0 0 0
20	Wheat 10 buſhels at 8s.	4 0 0
20	Wheat ſtubble in paſture	0 2 0
100	Five years, yield per acre	£.13 2 0

Expences per acre for five years.

Indian corn, ploughing, &c.	2	0 0
Oats, twice ploughed	1	0 0
Harrowing, and ſeed, and ſowing, and harveſting	0	14 0
Summer fallow	1	10 0
Wheat-ſeed and harveſting	1	0 0
Rent on five acres at 4s. a year	1	0 0
	£.7	4 0
Balance of profit on one acre in five years, or on five acres in one year	5	18 0
	13	2 0

Profit on farming by intervention of Fallow Crops inſtead of Fallow.

20 acres Indian corn	-	-	7	0 0
Do. Vetches 25 cwt. at 2/6	-		3	2 6
Do. Wheat 12 buſhels	-		4	16 0
Do. Clover 25 cwt. at 2/6	-		3	2 6
Do. Clover the ſame	-	-	3	2 6
Five year's produce of one acre or one year's of five.		£	21	3 6

Expences.

Indian corn	-	-	2 0 0
Ploughing corn-ground for vetches			0 10 0
Seed three buſhels and ſowing, &c.			0 12 0
Cutting and making hay	-	-	0 8 0
Vetch ſtubble ploughed once for wheat, ſeed and harveſting	-	-	1 10 0
12lb. clover-ſeed and ſowing	-		0 15 0
Mowing clover paid by the ſecond crop			0 0 0
Rent 20s. or 4s. a year	-		1 0 0
		£	6 15 0
To balance of profit per acre in five years or on five acres in one			14 8 6
		£	21 3 6

Thus while one farmer makes 1l. 3s. 5d. a year per acre, upon his hundred acres, clear of expenſe, the other makes 2l. 17s. 5d. the one gets little better than one hundred, while the other gets nearly three hundred a year. In the above ſtatement I have given one farmer credit for two buſhels of wheat more than the other, ſince I am perſuaded that the vetch crop will improve the ground more than the difference, as the dung given to the corn will not be exhauſted by the intervention of an oat crop before the wheat is ſown. To this profit ſhould alſo be added the continued advance in the improvement of

the crop by the one mode of huſbandry, and the continued decreaſe by the exhauſting the land in the other.

The fallow farmer has no fodder which the rotation crop farmer does not poſſeſs, except the ſtraw of his oats, which we will value at half a ton of hay per acre; he then has from his oats on

20 acres - -	Tons	10	0 0
The fallow crop farmer from 20 acres vetches		25	0 0
From 40 acres clover - -		50	0 0
		75	0 0
Deduct oat ſtraw - - -		10	0 0
Superiority to fallow crop farmer	Tons	65	0 0

He can thus winter at one ton a head, 65 head of cattle more than the fallowing farmer, and as each of theſe will afford at leaſt ſix loads of dung, he will be able to carry out yearly 390 loads of dung more than the fallowing farmer; beſides that he has one exhauſting crop leſs. It will be eaſy to ſee what difference this muſt make in a few years in the produce of a farm, and how much more it would be than I have rated it at. We often aſk with aſtoniſhment, how the Britiſh farmer can afford to pay a guinea an acre rent? the difficulty is ſolved if we examine the above ſtatement; ſince the difference between fallowing and eſtabliſhing a rotation of crops amounts to more than the difference of our rents and theirs; beſides that, their produce muſt be reckoned at a higher price. I know there are ſome ſtiff ſoils on which it would be difficult to eſtabliſh the rotation I mention, but this ſhould be no argument againſt it where the ſoil will admit of it, particularly as clover and vetches may be introduced with a certainty of ſucceſs, even if the ground ſhould be naturally poor, by the addition of only four buſhels of gypſum to the acre, which will indeed add 16s. a

year to the acreable expenſe, but it will at the ſame time in all probability add near a ton to the produce. I have gone into this digreſſion for the benefit of farmers into whoſe hands our publications may fall, and who have not had an opportunity of examining the great improvements that have of late years been made in Britain, by the introduction of clover and fallow crops inſtead of fallow. I would not be underſtood to confine my obſervations to vetches, which have not yet been ſufficiently tried in this country; potatoes, carrots, or peas, ſown thin, and cut green for provender, may all anſwer the purpoſe, but above all, clover. If this laſt is the only crop to be brought into the rotation, the ſyſtem muſt be changed to the following courſe: 1ſt, Corn; 2d, Barley and Clover; 3d, Clover; 4th, Clover; 5th, Wheat on one plowing; by this means a crop of clover will be ſubſtituted to a fallow. The wheat on a clover lay will require but one plowing, it will follow two improving crops. The dung which will be applied to the corn, will ſerve to bring forward the crop of barley, or oats, if that ſhould be preferred to barley; clover will do well with either.

I have now in the ground one acre of winter vetches; this looked extremely well laſt December, but as I have not ſeen them ſince, I know not whether they will ſtand our winters; the reſult therefore of this experiment muſt make the ſubject of a future communication.

March 16, 1796.

Obſervations on the Smut of Wheat, and the Means of preventing it. By EZRA L'HOMMEDIEU, *Vice-Preſident of the Society.*

THIS diſeaſe, if it may be ſo called, in wheat, has attracted the attention of many ingenious

writers on huſbandry, in France and England, as well as other parts of Europe. In this ſtate, eſpecially in the weſtern and northern parts, the farmers are frequently great ſufferers by the ſmut; the deſign of this paper is to lay before the ſociety the conjectures which have been made reſpecting its origin, and the modes of prevention, together with the methods uſed for cleaning the ſmutty wheat.

The general opinion is, that it is a diſeaſe ariſing from the air or atmoſphere, or from unſeaſonable cold and wet, but in what manner the diſeaſe is produced, the different writers are as much divided in opinion, as our phyſicians are reſpecting the cauſes of the yellow fever, or many other diſorders among us. The operations of nature are ſo ſubtile in moſt caſes, in the production of diſeaſes in the animal as well as the vegetable creation, that we muſt apply the remedy before we can inveſtigate the cauſe. By many experiments which have been made, it is probable this diſorder in wheat is contagious. It is obſerved here as well as in Europe, that ſmutty wheat generally produces the like kind. From which obſervations many experiments have been made to exclude the ſmut from the grain to be ſown, and ſo far to deſtroy the ſmut, that the wheat will not be affected by it when ſown. In Young's Annals, vol. x. page 231, we have the following experiments, which may be uſeful to farmers of this ſtate, whoſe fields are ſubject to raiſing ſmutty wheat:

December 7, 1787. Sowed fourteen beds with the ſame wheat ſeed, as black with the ſmut as ever I ſaw any.

No. 1.	Sown dry nothing done to it, had	377	ſmutty ears.
2.	Waſhed well in clean water, had	325	do.
3.	do. in lime water, had	43	do.
4.	do. in a lye of wood aſhes, had	31	do.
5.	do. in arſenic and ſalt mixture, had	28	do.
6.	Steeped in lime water four hours, had	12	do.
7.	do. in lye four hours, had	3	do.
8.	do. in arſenic four hours, had	1	do.

No. 9.	do.	in lime water twelve hours, had	6	ſmutty ears.
10.	do.	in lye twelve hours, had	0	do.
11.	do.	in arſenic twelve hours, had	4	do.
12.	do.	in lime water 24 hours, had	0	do.
13.	do.	in lye twenty-four hours, had	0	do.
14.	do.	in the arſenic 24 hours, had	5	do.

I have ſeen a receipt of Mr. J. Harvey, of Worceſterſhire, in England, to clear ſmutty wheat, which is worth noticing: he ſays, "We take ſome of the redeſt marl, or clay, and dry it in the oven, after drawing bread out, and when dry enough, we powder it in the cider-mill, as being the quickeſt way, to fine flour, and put it in an old tub or ſuch thing, in the barn, and when the threſher has ſpread about twelve ſheaves on the floor, he takes about a pint of the powder and dreſſes it chiefly on the ears of the corn, through a hair ſieve. During threſhing, the red duſt predominating, keeps the ſmut from taking effect. If the ſieve is fine through which the duſt was paſſed, it will all blow away in winnowing, and the wheat will be ſo free from it, that no man can tell it has been marled."

Obſervations on Cankerworms, and the Means of preventing their Effects. By SAMUEL L. MITCHELL, *M. D. Secretary of the Society.*

FEW ſubjects on rural economy more ſeriouſly deſerve our attention than the hiſtory of the inſects which infeſt our fields and gardens. The alarming accounts that we hear from almoſt every quarter of our country, of the ravages committed by theſe creatures, are ſufficient to call our attention to the means of preventing the further extenſion of their miſchief. No method bids ſo fair to accompliſh this end, as a collection of the facts reſpecting the life, ſubſiſtence and propagation of each ſpecies;

and fortunately, ſo many of the members of this ſociety reſide in the country, and the productions of their farms are in ſo many ways injured by ſome or other of the inſect tribes, that the means of acquiring the neceſſary information, requires but an examination of the appearances that preſent themſelves, on the ſpot, and the arrangement of theſe into a regular narrative.

The economy of nature as it reſpects this part of the creation, is very remarkable. The number of inſects known, perhaps ſurpaſſes that of all the reſt of the animal ſpecies put together; and if to theſe we add the unknown, as doubtleſs a large proportion of them remain unnoticed by us, we ſhall find by far the moſt numerous claſs of animals referable to this head. Yet vaſt as their numbers and great as their multiplicative powers may be, it is highly worthy of obſervation, how few of them are any how immediately ſerviceable to man. When we have mentioned the honey-bee, the ſilk-worm, the gall, vermes and cochineal inſects, and the Spaniſh fly, we are nearly at the end of the catalogue, and the reſt, if not directly noxious to man, or to the plants and animals uſeful to him, are however of ſo little importance, that for ought he knows, they anſwer no directly uſeful purpoſe to him in this ſyſtem of things.

In the politics of nature, however, it muſt be owned, they ſeem to have their employment; for they feed upon living vegetables, and thereby keep down their too luxuriant growth, which might otherwiſe over-run the earth, to the great inconvenience of man and other creatures; they devour dead and putrefying animal and vegetable ſubſtances, and thereby tend to keep the air wholeſome and clean; they afford food to thouſands of birds and other animals, who conſtantly prey upon them; myriads of them dying in or at the ſurface of the earth, contribute to manure and fertilize the ground,

and thus aid vegetation; and ſome of them are highly valued as articles of diet by man himſelf. Nor ought it to be forgotten that if life is a bleſſing at all, the comforts and enjoyments of animated exiſtence are thus infinitely extended and diverſified, ſince the beetle that dwells in the muck of the way-ſide, and the ſpider who abides amidſt the darkneſs and dampneſs of a cellar, appear to poſſeſs their proper ſhare of happineſs.

Although ſo few of them are ſerviceable to mankind, their hiſtory is ſtill very intereſting, particularly ſuch of them as infeſt the plants and animals which we are moſt deſirous to rear and cultivate, and there is work enough of that kind yet remaining undone to employ all the diligence and acuteneſs of the Swammerdams, Liſters, Reaumurs, De Geers and Von Rohrs of our times: fortunate if by their labors we could ſecure our wheat from the ravage of the fly; our grapes from the deſtruction of the gryllus; our grain from the eroſion of the weavil, *(urculio)* and our orchards from the ſpoiling of the cankerworm, *(phalæna.)*

Theſe reflections are intended as an introduction to a few facts that have lately occurred to me on the ſubject of the laſt named inſect, the inveſtigation of whoſe way of life may lead us poſſibly to ſome method of deſtroying it, or at leaſt of preventing its deſtructive effects. They are not offered as a complete hiſtory, but as a ſeries of facts tending toward an hiſtory.

This animal is of that kind called a miller, *(phalæna)* and like many others of that family, ſeems to be an inſect of the night. In the day time it conceals itſelf in holes and ſpaces under the looſe and ſhaggy bark of the apple-tree, and may be eaſily found by ſearching. The male has wings which enable him to fly, but the female appears to have no wings at all, and therefore muſt aſcend the tree by creeping up the body. The ſpecimens of

the inſect herewith preſented, will confirm the truth of this obſervation. I have ſeen them as ſoon as the 25th of March this year, in great numbers in an orchard at Newtown, and at that very early part of the ſeaſon, their time of copulation had arrived.

There is a proviſion in nature for ſupplying with food, every ſpecies of animal, at its proper time; and the arrangement in this caſe ſeems to be, that the hatching of this brood of young ones ſhall coincide with the budding and growth of the apple-tree leaves. By an inſtinct of the parent, her eggs are laid in ſuch a place as will furniſh to her progeny the aliment moſt nutritious and agreeable to their conſtitution: and accordingly on the day above mentioned, the female was ſeen crawling along towards the extremities of the twigs, to be there ready to make her depoſit and die. Thus as ſoon as the leaves unfold and ſprout forth, the worm burſts from the egg; ſince the ſame degree of heat which cauſes the one to vegetate, ſerves to vivify the other. The tender and expanding foilage, thus attacked by its enemies, then keen and voracious, can neither miniſter to the wants of the bloſſom, nor perform its perſpiratory nor reſpiratory functions to the tree. Whatever endeavors the tree may make to get the better of the foes which beſet it, is accompanied with a proportional growth on their part, and probably an increaſe of their numbers; and if by an extraordinary effort, the flowers ſhould open, they will be very likely to ſhare the fate of the leaves; or if young fruit ſhould be produced, there will be ſcarcely any chance of its advancing to ripeneſs.

Robbed thus of its leaves, bloſſoms and fruit, an orchard can be of little value to its owner. The growth of the trees is checked, the branches grow dwarfiſh and ſhrubby, and moſs and other paraſidial plants take poſſeſſion of the bark. Preyed upon in this manner, ſome trees are deſtroyed in a few ſea-

ſons, while others of a hardier kind, linger along for a dozen years and more. And lamentably it too often happens, that the orchard, of which the cankerworms have once taken poſſeſſion, continues ever afterwards to be their habitation.

Mr. Forſkall (3. *Amenitat. Academ.* p. 294) has enumerated twenty ſpecies of inſects which feed upon the apple-tree; and of them, ſeventeen are *phalænas* (millers;) nor do I believe theſe are the whole; yet it ſeems to be pretty evident that the united miſchief of them all, does not equal the ravages committed by the cankerworm alone. A long and regular enumeration of troubleſome and deſtructive creatures of this claſs, is given by Mr. Baeckner, in his *Noxa Inſectorum.* (Ibid, 335.)

From the facts ſtated, ſeveral inferences may be drawn, reſpecting the preſervation of orchards. Inſects in their full grown ſtate, or in their laſt ſtage of metamorphoſis, frequently eat not at all, and ſeldom do much harm; their deſtination during that portion of their life, being not ſo much to preſerve the individual as to continue the ſpecies. Nothing then is to be apprehend from the parent inſects in the early part of the ſeaſon, which die in a very ſhort time after propagation.

The male inſects, though furniſhed with wings, are to be very little regarded; for although they flit about in ſwarms and thicken the air, the trees cannot be injured by them, as they neither devour the leaves nor leave behind them any of their breed.

But the method of prevention will depend upon keeping the female from aſcending the tree and placing her young at the extremities of the twigs. As ſhe is deſtitute of wings, and does not appear to be carried by the male, there is only one way by which ſhe can aſcend the tree, and that is by creeping up the body. If ſhe winters in the earth, whatever has a tendency to deſtroy her there, or to obſtruct her courſe to the tree, or her paſſage up it, or her congreſs

with the male afterwards, will be conducive to the end. The practice of tarring and of putting other impediments to their aſcent, upon the bodies of trees, is therefore well judged and proper, but muſt be employed ſo early, as to prevent the riſing of the females, otherwiſe it will be uſeleſs; for although the males may appear to deſcend from the trees to the earth, and to move about in all directions, yet if once the females get into the tree, it ſeems as if they never go down, until they quit their hold after death. The deſtruction of a few of the winged ones, or males, then by the tar, when daubed on late in the ſeaſon, is of little conſequence, and incapable of producing the expected effect.

Having obſerved the female, as well as the male, as early as the 25th of March, to lurk under the portions of dead bark, which cover the bodies of the trees, I have no doubt that *the ſcraping off all theſe lifeleſs fragments* of rind, would be a very beneficial practice. By doing this ſeveral valuable conſequences would enſue: 1. The aſcent of the female would be much more difficult on the ſmooth bark, than at preſent amidſt its roughneſſes; and exhauſted by ſuch a fatiguing journey without reſting places, ſhe would probably fall off before ſhe had climbed to the boughs. 2. The means of concealment being thus taken away, obſervation could be made with more accuracy and leſs trouble than at preſent, concerning the progreſs ſhe made, and how her motions correſponded with the temperature of the weather, ſo that methods could be deviſed and adopted accordingly for preventing her aſcent, or for her deſtruction. 3. In like manner ſhe would be more expoſed to the blaſts of wind, and to the alternations of cold, which might both have a tendency to diſlodge her; as for inſtance, during this very ſeaſon, after two or three days of very warm and beautful weather, after the arrival of robins and ſeveral other ſpecies of migrating birds, and ſwelling of lillach-buds,

there began on the night of the 26th of March, a furious northeaſtwardly gale of wind, attended with a fall of ſnow and hail, which laſted forty-eight hours, and was more abundant than any we had experienced during the winter. In ſuch a time, there is no doubt in my mind, that if theſe inſects had not been protected by the ſhreds of outer dead bark, they muſt have become torpid by cold, and then been blown from the tree and periſhed in the ſnow. 4. If any of them, which is not an improbable ſuppoſition, paſs the cold ſeaſon under this ſhelter, by ſcraping the trees their wintering place will be deſtroyed. 5. Many of our migrating birds live upon inſects; theſe latter, by the propenſity of their nature, hide themſelves as much as poſſible from their deſtroyers, and thus preſerve their lives: on removing the ſlips of uſeleſs and decayed bark, which may be done without injury to the tree, the female inſects on their whole journey upwards, will be expoſed to the view of their enemies, and doubtleſs ſuffer thereby great diminution of their number.

It is a vulgar remark, "*Muſcos et muſcas legat, cui, aluid non ſuppetit negotium,*" and the idea of unworthineſs or inſignificance, generally aſſociated with theſe and ſimilar enquiries, has deterred many obſervers from communicating and publiſhing their knowledge. For my own part, I am quite ſatisfied, however mean and little the cauſe of our calamities may be, that cauſe, when it lays waſte the productions of the earth, fruſtrates our agricultural labors, and deprives us of the enjoyment and reward we expected from both, merits the inveſtigation of all, whoſe capacity and ſituation enable them to note facts. On this occaſion I am happy in following the example of our ingenious member, who has with much diſcernment and ability, deſcribed the wheat-inſect or Heſſian fly, (Mr. Havens, *Agricultural Tranſactions, New-York*, part 1,) and of our worthy Vice-Preſident (Mr. L'Hommedieu) who has given

us ſome notices of the inſect deſtructive to the thorn and cherry trees in Suffolk county, (*Ibid*, part 2,) and from whom we expect further information; concluding in the ſentiment of our excellent and patriotic Preſident, (Mr. Chancellor Livingſton) "that the man who has taught us to guard againſt the ravages of noxious inſects, will be remembered with gratitude as the benefactor of ſociety."

March 30, 1795.

On preſerving and propagating Trees.

THE committee appointed to report on the beſt mode of preſerving and increaſing the growth of wood and valuable timber, reſpectfully ſubmit to the ſociety the following obſervations:

1. In thoſe parts of the country where wood and timber are ſcarce, the wood lands ought to be incloſed, to guard the young growth from cattle and ſheep.

2. If the woods are old and decaying, it is moſt profitable to clear the land and let it lie for a new growth. In clearing ſuch lands, it is beſt to cut all the trees, great and ſmall, that the young trees may have an equal advantage of ſun and air. There will be no need of pruning or thinning the growth, for if kept in fence, the trees will take care of themſelves; nature in this caſe will do all that is required, and much better than art and labor.

3. This mode of propagating wood and timber is profitable, eſpecially on poor land, which cannot be put to other uſe. About twenty years ago, one of the committee purchaſed ten acres of poor, light land, at 2½ dollars an acre, which had juſt been cleared of the wood. Not being encloſed the young wood was much injured by the cattle; but a growth of trees has notwithſtanding overſpread the land, and

and it is now worth, from this circumſtance alone, about 12 dollars an acre.

4. Experience teaches that when young ſprouts have been nipped or bitten by cattle, if the land is deſigned for a growth of timber, it is beſt to cut all the ſprouts that have been injured, cloſe to the ground: new ſprouts will then ſhoot up in a ſtrait direction; by this means many hoop-poles may be cut to advantage.

5. Woods ought not to be thinned too much. If they are made ſo open as to admit the rays of the ſun to the earth a ſward will ſoon cover it, which will prevent the growth of the trees, and cauſe them to decay. To prevent this the wood ſhould be fenced, and the thick growth from the nuts and acorns will ſoon deſtroy the graſs, and preſerve the earth light and moiſt.

6. The foregoing rule is particularly applicable to foreſts intended for fuel, in which a rapid growth and large quantity of wood is deſired. Some more latitude may be uſeful in cultivating wood for durable timber; as experience ſhows that wood growing in thick ſhade and a moiſt air, is not ſo hard as that which has the benefit of the ſun and free air.

7. It is probable that much poor and worn out land in this country would, if appropriated to the raiſing of wood ſolely, become very profitable. Few experiments have yet been made among us; but the practice of Europeans will go far to ſettle this point. It is found in Europe, that tranſplanted trees will not grow as well, nor as large and thrifty, as thoſe which grow from the nut, acorn, or ſeed; and that the latter ſucceed beſt, where the leaſt labor is beſtowed in preparing the land. Oaks are beſt propagated by leaving the acorns on the ſurface of the ground, covered by the graſs; but in this way, the acorns are expoſed to be devoured by animals. To prevent this, it is recommended to preſerve them through the winter, and plant them in the following

manner; firſt make a bed of loam about ſix inches deep; on this plant the acorns about two inches deep; over them lay another bed of ſix inches of earth; over that another layer of acorns, and ſo on, as far as occaſion requires. The whole muſt be ſo covered with earth, as to preſerve them from the froſt. Early in the ſpring, the bed is to be opened, when the acorns, which will have begun to ſhoot, are to be planted about a foot's diſtance from each other.

8. Another mode of planting them, is, to dig a ſmall hole with a pick-axe, and drop the acorn, covering it with earth. This is a very ſimple method; but care muſt be taken not to bury the ſeed too deep: two inches is found to be the beſt depth. The leſs covering the better, provided the acorn is ſecured from birds and other animals.

9. Another practice is to pare the earth with a plough, and plant the acorns in rows, covering them with the turf. This is not a great deal of labor, and will ſecure the acorns from animals. One drops the acorns while another covers them. The diſtance of the rows may be at any man's pleaſure; but the thicker the trees, the ſooner will the ground be ſhaded, and the turf deſtroyed. As the young trees advance, the weaker ones will die, and the vigorous and thrifty only ſurvive. Nature thus will ſupereede the uſe of the pruner's hand.

10. As wood for fuel and timber is becoming ſcarce and dear, along the ſea-coaſt of theſe ſtates, the committee would recommend that ſome ſteps be taken by the ſociety, to encourage the cultivation of trees. It is probable that great numbers of old fields might in this way be converted into very profitable lands. It is a circumſtance that deſerves particular notice, that vegetation is ordained to be the natural fertilizer of the earth; and it is a happy arrangement in the economy of nature, that the moſt uſeful of vegetable productions, furniſh this fertility

in greateſt abundance. Graſs contributes to enrich land much more than weeds; and uſeful foreſt-trees, by the leaves they depoſit every autumn, create a deep rich mould, that benefits the earth much more than uſeleſs ſhrubbery.

Hence trees planted on impoveriſhed fields, will, as they grow, furniſh the earth annually with a portion of vegetable nutriment: and the land, while it ſuſtains a valuable foreſt of wood, is continually growing richer, and fitted for cultivation, when the wood ſhall be taken off.

This beautiful order in the vegetable world, ſeems to reſemble the harmony of the moral ſyſtem, in which duty and intereſt are invariably connected.

An Account of ſome of the Natural Productions of the Weſtern Part of this State; In a Letter to the Secretary. *By* JOHN W. WATKINS, *Eſq.*

DESIROUS of making uſeful my obſervations on the natural products of the new ſettling part of this ſtate, I tranſmit you ſamples of ſuch of them as I have collected, and judge worthy the attention of the agricultural ſociety:

Encloſed in the paper marked number one, is a ſample of what is called *winter-graſs*; part collected the laſt ſummer, and part in November; alſo, ſome roots of the graſs in vegetation. Theſe ſamples ſupercede the neceſſity of a deſcription of the foilage. Growing in ſtools like wheat, the roots being ſlender and taking but light hold of the earth, it requires a nouriſhing and light or loamy ſoil to vegetate in, of courſe it is in general found, and there only thrifty, in beach and maple lands, which are commonly clay or marl bottoms with a more or leſs covering of light, loomy, vegetable mould. The winter ſeems to make no impreſſion on this graſs, I have ſeen it look thrif-

ty and green among other graſſes which the froſt had deſtroyed. When the ſnow leaves the ground in the ſpring it furniſhes a nouriſhing paſture that cattle are fond of. I am inclined to believe it would make a valuable feed for ſheep who want green food early in the ſpring, ſhould its juices be found congenial to their conſtitutions, as it is ſaid to poſſeſs ſome medicinal properties.

Encloſure No. 2, contains a ſample of the wild pea. The bloſſom of it is purple mixed with white, the pod flat, exceeding an inch in length, the ſeeds ſmall. I judge it to be a perennial, as it grows in a meadow of mine which has for ſeveral years been cut before the pods opened to diſcharge the ſeed. It requires rich and moiſt land, and is generally found where there is ſtrong graſs or weeds by which it can be ſupported. For paſture it affords a feed cattle are fond of, but it would not be profitably uſed that way, as when fed down it appears to take a long time to recover its growth. Its excellence is as a fodder, for which it is preferred to clover for nouriſhment, and over which it has this advantage, that when cured in proper time the ſtalk is not as brittle and the leaves do not pulveriſe as readily as thoſe of clover, as may be perceived by the ſample. I conclude it would be beſt mixed with timothy or ſome kind of graſs that has tall and flower ſtalks, to which the tendrils of the vine can faſten, and enable it to have the moſt profitable growth: In ſuch a ſituation I have ſeen it four feet high. I regret that my people have diſappointed me in not collecting ſome of the ſeed as I had directed.

Encloſure No. 3, contains the *ſeed-ears* of a graſs of the culmiferous kind; the leaves are long, about half an inch wide, terminating in a point, and growing from the roots: the flower ſtalks are numerous, about two feet in length, ſlender, and having each a ſingle head. This graſs when rubbed, has an agreeable ſmell. I met with it at a farm-houſe, and was

informed that it had been firſt noticed laſt year, and was ſuppoſed to have been brought by ſome birds. I obſerved it growing at the ſide of a hill of clay land. The peculiar property attached to it by the farmer, was, its ability to reſiſt a dry ſeaſon, as he had noticed it to be in full verdure during the uncommon drought the laſt ſummer, when the other graſſes were periſhing. The great quantity of ſeed it produces, and the abundance of leaves, make it a very nouriſhing paſture, to which uſe it ſhould be applied, as it very eaſily ſheds its ſeed.

Encloſure No. 4, contains the roots, flowers and leaves of *ipecacuanha*, which grows abundantly in many parts of the country. How far its properties may render it uſeful, experience in the uſe of it can only determine; it is to be deſired it may, and ſuperſede the neceſſity of importing. It is ſaid not to be as ſtrong as the imported: this may be owing to its not being cultivated, or growing under the ſhades of a foreſt; it may at the ſame time have balſamic virtues, ariſing from a difference of ſoil and climate, the imported has not; the Peru and Brazil ipecacuanha differ in this reſpect. I have been informed the Indians uſe an infuſion of it in ſpirits (practiſed alſo by ſome of the preſent inhabitants) in a violent bilious remittent fever, which generally ſeizes the patient with violent pains in the head, back and limbs, a tenſe ſkin, ſick ſtomach, inſatiable thirſt, and when not early relieved, with ſtrong convulſive affections, a yellow ſkin, ſucceeding evacuations, which they firſt endeavor to effect by ſweating.

No. 5 encloſes ſamples of the Indian hemp, in its flowering ſtate, having completed its growth and ripened its ſeed, and the cortex of a rotten ſtalk; alſo ſome of the ſeed. Whence it will not be neceſſary to give any deſcription of the plant, although eſſentially different in appearance from the common kind. The fibres of the bark are very fine, ſtrong and of a light colour; I do not apprehend it will be as proper

as the common hemp for cordage, but for ſome kinds of linen, ſtockings, canvaſs and ſmall cords, it may be found ſuperior, from its ſuperior ſtrength. Linen and lines made of it have been found ſtrong and durable. It grows in wet rich land: I have ſeen it growing where the water remained on the land near five months, and have been informed it is not an annual, which I am inclined to believe, from the long time ſome land producing it, is under water; which circumſtance induces me to ſuppoſe it ſimilar to a kind I have been told grows in ſome parts of the Ruſſian dominions, which is ſown every five or ſix years. Should it be found uſeful, it has the advantage of furniſhing a product from lands unfit from their wetneſs for any other cultivation, as the ſeed may there be depoſited in the laſt of the dry ſeaſon for the next year's growth, by a harrow. It may be objected that the ſeed would rot by being a long time under water, which is anſwered by their being in an uncultivated ſtate of vegetation, ſhed from the plant in the fall, and remaining part of the winter and all the ſpring under water.

I endeavored to inform myſelf reſpecting the rice of the lakes, but could not diſcover it was any where to be met with on this ſide lake Superior, where it it is ſaid to grow in abundance in the water, the Indians uſing it for food. Upon the purple dye made uſe of by the Indians for ſtaining the quills on their belts, my enquiries were not ſatisfactory; ſome information leading to a belief it was procured from a root; other information that it was procured from hemlock and black alder barks, which is known to be what they ſtain their baſkets red with. Alder produces a rich yellow; hemlock, a deep red; duly compounded they may produce a bright red, or a purple.

Means of preſerving Mildewed Wheat from injury. Communicated by Mr. L'HOMMEDIEU.

"A FINE piece of wheat being lodged by heavy rains, and being ſoon after perceived to be infected with the mildew, was cut, though in a perfectly green ſtate, namely, about three weeks before the uſual time of cutting. It lay ſpread abroad upon the ſtubble until it became dry enough to prevent its caking in the ſheaf, when it was bound and ſet up in ſtacks. The reſult of this treatment was, the grain, though ſmall, was of a fine colour, and the heavieſt wheat which grew upon the ſame farm that ſeaſon, owing, no doubt, to the thinneſs of its ſkin. What appears more remarkable, the ſtraw was perfectly bright, not a ſpeck upon it. The idea of the judicious manager in whoſe practice this experiment took place is, that cutting the crop "as ſoon as it is ſtruck *kills* the mildew," and on this principle he practices himſelf, and recommends in general terms the cutting of mildewed wheat "as ſoon as it is ſtruck." It is well underſtood that the ſap or nutriment which is in the ſtems of corn that is cut unripe, circulates to the ear, and fills the grain in the ſame, or in a ſimilar manner as it would have done, had the ſtems remained upon their roots. Hence the advantage of cutting mildewed wheat as ſoon as it is infected with the diſeaſe ſeems to be, that, by thus ſtopping the diſeaſe, the nouriſhment in the ſtraw paſſes to the ear in a pure, untainted ſtate." *Marſhall's Glouceſterſhire, v. 2. p.* 54.

When the wheat-ſtem has a very particular caſt of colour of bluiſh green, it is ſurely affected by the mildew. *Young's Annals, v.* 1, *p.* 332.

Method of curing Diſeaſes of Fruit Trees, &c.

Communicated by Mr. L'HOMMEDIEU.

" *Directions for making a Compoſition for curing Diſeaſes, Defects, and Injuries in all kinds of Fruit and Foreſt Trees, and the Method of preparing the Trees and laying on the Compoſition, by* WILLIAM FORSYTH."

" TAKE one buſhel of freſh cow dung, half a buſhel of lime rubbiſh of old buildings, (that from the ceilings of rooms is preferable) half a buſhel of wood aſhes, and a ſixteenth part of a buſhel of pit or river ſand; the three laſt articles are to be ſifted fine before they are mixed; then work them well together with a ſpade, and afterwards with a wooden beater, until the ſtuff is very ſmooth, like fine plaiſter uſed for the ceilings of rooms.

" The compoſition being thus made, care muſt be taken to prepare the tree properly for its application, by cutting away all the dead, decayed and injured part, till you come to the freſh, ſound wood, leaving the ſurface of the wood very ſmooth, and rounding off the edges of the bark with a drawknife, or other inſtrument, perfectly ſmooth, which muſt be particularly attended to; then lay on the plaiſter, about one eighth of an inch thick, all over the part where the wood or bark has been ſo cut away, finiſhing off the edges as thin as poſſible; then take a quantity of dry powder of wood aſhes, mixed with a ſixth part of the ſame quantity of the aſhes of burnt bones; put it into a tin box, with holes in the top, and ſhake the powder on the ſurface of the plaiſter, till the whole is covered over with it, letting it remain for half an hour to abſorb the moiſture; then apply more powder, rubbing it on gently with the hand, and repeating the application of the powder till the whole plaiſter becomes a dry, ſmooth ſurface.

" All trees cut down near the ground ſhould have the ſurface made quite ſmooth, rounding it off in a ſmall degree, as before mentioned, and the dry powder directed to be uſed afterwards, ſhould have an equal quantity of powder of alabaſter mixed with it, in order the better to reſiſt the dripping of trees, and heavy rains.

" If any of the compoſition be left for a future occaſion, it ſhould be kept in a tub, or other veſſel, and urine of any kind poured on it, ſo as to cover the ſurface, otherwiſe the atmoſphere will greatly hurt the efficacy of the application.

" Where lime rubbiſh of old buildings cannot be eaſily got, take pounded chalk, or common lime, after having been ſlacked a month at leaſt.

" As the growth of the tree will gradually affect the plaiſter, by raiſing up its edges next the bark, care ſhould be taken, where that happens, to rub it over with the finger, when occaſion may require (which is beſt done when moiſtened by rain) that the plaiſter may be kept whole, to prevent the air and wet from penetrating into the wound."

Royal Gardens, Kenſington, May 1, 1791.

ON MANURES.

Thoughts on Lime and Gypſum ; By Chancellor LIVINGSTON, *Preſident of the Society.*

I SOME years ago ſubmitted to the ſociety a few experiments on gypſum, and ventured to offer a theory, which I thought might tend to reconcile the various extraordinary phenomena attending its operation. I have the pleaſure of finding that my own experience and that of others add weight to my conjectures. Dr. Mitchell, who has employed

ſome time and attention in inveſtigating the ſubject, appears to have done me the honor to adopt my theory, when he informs the ſociety, that "The leading idea in his ſyſtem, is, that when gypſum does good, it is by virtue of its own decompoſition, and that this is effected by the preſence of an alkali in the ſoil, which takes away the ſulphuric acid, and allows the ſeptic (nitrous) acid to combine with lime into calcarious nitre." My own idea, as I have ſince ſtated, has always been, that the effect of gypſum as a manure, depends upon a repeated decompoſition and renovation of the ſelenite: The firſt by the acids uniting with an alkali; the ſecond by the attraction that ſubſiſts between the cauſtic calcarious earth, and ſuch acids as the air contains. Whether theſe acids are the ſulphuric, phoſphoric, nitrous, or carbonic, I am unable to ſay. I am led to believe, that the acid and alkali by which the gypſum undergoes this alternate decompoſition and renovation is preſented by thoſe ſubſtances floating in a gaſſious form in the air, rather than by any thing contained in the earth; having found from repeated experience, that the ſteep ſide of a barren ſand hill, turned up conſiderably below the vegetable mould, will produce good clover with gypſum. If the alkali exiſted in the earth, I can conceive no reaſon why the acid ſhould not form an immediate combination without the intervention of gypſum. The uſe of the plaiſter of Paris conſiſts, in my opinion, in arreſting alkaline clouds or vapors by means of its acid, and afterwards ſuch as are acid by its cauſtic, calcarious baſe. In this way from the irregularity and uncertainty of the approach of theſe vapors, we may account for the rapid operation of gypſum at ſome times, and for its lying at others a long time in the ground without producing any viſible effects; and for its doing no injury when uſed in large quantities, and for the effect of the ſmalleſt that can be evenly applied. This would neceſſari-

ly happen if the materials for its decompoſition and renovation exiſted in the atmoſphere, only in ſufficient quantity to act upon a ſmall proportion of the gypſum. Nor can plaiſter of Paris operate as a ſtimulant, for in ſuch caſe the larger quantity would deſtroy plants, or the ſmaller be of no comparative uſe. I have ſeen wheat growing in a hogſhead of gypſum ſtanding in a moiſt ſituation, apparently in the moſt perfect health and vigor, and have ſpread it on ſpots at the rate of a thouſand buſhels to the acre, over plants, without finding that they were injured by it, though it is well known that one buſhel ſpread over an acre of poor land will have a very powerful effect. The abſolute inefficacy of gypſum near the ſea, can I think, be accounted for in no way ſo naturally as by ſuppoſing that the calcarious baſe of gypſum after it has parted with its ſulphuric acid, unites with the muriatic acid, with which itis known to form a mucilage which the firſt rain will carry off; whereas with every other acid, it unites into a ſelenite in a great meaſure inſoluble in water.

I have been induced to touch upon this ſubject to guard againſt adopting an opinion (which ſeems to derive ſupport from Mr. Peters' very valuable pamphlet) that gypſum acts merely as a ſtimulant, and as ſuch exhauſts the fertility of the ſoil. This opinion, though favored by Mr. Peters, is evidently not ſupported by the facts he adduces. All his correſpondents admit that their grounds improve by it; but ſome of them ſay that they do ſo more rapidly when uſed in conjunction with dung, a circumſtance which it certanly did not require the aid of experience to prove.

As I write not to ſupport a theory, but to promote inquiry, I ſhall ſtate an objection of ſome weight, which I think may be made to that I have endeavored to eſtabliſh. If the air contains acids ready to unite with cauſtic, calcarious earths, why does not quicklime produce the effect of plaiſter of Paris? that it

does not I admit, as well as that I am not perfectly ſatisfied that I can anſwer the objection. The apparently contradictory operations of nature are in many inſtances not to be accounted for by the moſt ſkillful philoſophers, though they devote their time and their talents to the inquiry; that they ſhould eſcape thoſe who have leſs time and fewer talents to beſtow on the ſubject, ſhould not be matter of much ſurpriſe. I will, however, ſtate what may poſſibly be the cauſe of his difference, and leave it to abler chymiſts to appreciate my reaſoning. Are we ſure that the calcarious earth of lime is minutely the ſame with that of gypſum? they certainly exhibit apparent differences during their calcination, and after they are calcined. It may happen that ſomething in the conformation of the parts of the laſt, or ſome ingredient in its compoſition may render it leſs tenacious of carbonic acid, than the firſt. Lime will not part with its acid to volatile alkali or potaſh: the operation therefore that makes the baſis of my theory, would be very uncertain, if the earth of gypſum is in every particular, when deprived of its acid, ſimilar to quick-lime, unleſs it was effected by ſome other acid that has a ſlighter comparative affinity to lime, or a greater attachment to alkali than carbonic acid has. It appears to me however, that the earth of limeſtone is leſs tenacious of its acid before than after calcination. Before calcination if reduced to an impalpable powder and lixiviated with a ſolution of potaſh, carbonic acid may be obtained.

Permit me ſince I have wandered thus far into the fields of conjecture, to venture one ſtep further, before I quit the fairy land. The operation of lime as a manure, ſeems to me little underſtood. Its advantage is ſuppoſed to ariſe from its rendering oils miſcible with water, and from its deſtroying vegetable ſubſtances in the ſoil, and rendering them fit food for plants; to theſe ſuppoſitions there are at leaſt plauſible objections, which I will not ſtop to

examine, but produce my own conjectures, as founded upon what I take to be eſtabliſhed facts. As far as I can learn from Britiſh writers upon the ſubject, lime promotes the growth of ſome plants, and is deſtructive to others. Thus, furze, fern, and the native wild graſſes of Britain are killed by it, while it improves corn, clover and the cultivated graſſes. But as it is to be preſumed that oils and putrid vegetables are as much the food of plants to which lime is deſtructive, as to thoſe that are benefited by it, we muſt ſuppoſe that it does not operate only in the manner that is alledged, and ſeek that principle in lime, which makes it friendly to ſome, while it is injurious to other plants. To come at this we muſt inquire into the nature of thoſe that are injured or benefited. Thoſe that are injured, are the natives of a cold moiſt climate, and ſuch as would probably not ſubſiſt in a warm one. Thoſe that thrive are ſuch as have been tranſplanted from a warmer to a colder climate. The grain cultivated in Britain, and clover, with many of their valuable graſſes, owe their birth to much warmer climates, from whence they have progreſſed ſlowly toward the north, where they have been gradually naturalized, without however, being yet ſo hardy as to defend themſelves againſt the inclemency of the country without care and culture. As the natives of a cold climate are intolerant of heat, ſo thoſe of a warm one will retain their affection for it, and flouriſh where a due proportion of it can be obtained. Lime is reduced to a calx by means of intenſe heat. It is probable that a great proportion of calorique or the matter of heat is fixed in the operation, as light appears to be for a time in the Bologna ſtone, white paper, and many other combuſtible ſubſtances, but in much greater degree and more permanently. Without, however, affirming the exiſtence of ſuch heat, which the chymiſt may be diſpoſed to diſpute, I will only ſuppoſe that they will not deny, that lime is by its uni-

on with water and carbonic acid, gradually returning to its original ſtate, in this caſe the water, the fixed air (and perhaps the calx) give out heat, and where they do this too rapidly, they evolve ſo much of it as to excite combuſtion. As lime is very long in returning to its firſt ſtate, it will be long uſeful to plants that require heat. Lime may alſo be uſeful even when effete in furniſhing that calcarious earth which enters into their compoſition. If this theory is juſt, it will account for the little advantage to be derived from lime as a manure (except in ſome very peculiar ſoils) in this country. Our ſummer treads cloſe upon the heels of ſpring; the corn no ſooner begins to vegetate, than it receives a warmth equal to that of the country from which it originally ſprung: accordingly we find that the growth of corn is more rapid here by one-third, than it is in Britain; and even there, if I am rightly informed, lime is moſt univerſally uſed in the north, where grain requires more heat. It may be aſked why lime on this ſyſtem exhauſts the land? obviouſly becauſe without adding any thing to the ſoil, it enables the plants to take more from it. But enough of conjectures that are thrown out to provoke inquiry. If thoſe who have more leiſure purſue it, I ſhall receive from them with equal pleaſure, the detection of my error or a confirmation of my theory.

Obſervations on the Growth and Nouriſhment of Plants.

By EZRA L'HOMMEDIEU,
Vice-Preſident of the Society.

IN conſidering the growth of plants and vegetables we ſhall inquire, as far as we are able, into their food or nouriſhment, and in doing this ſhall endeavor to go no further than we can be juſtified by

facts and appearances. I believe we are on ſafe ground when we ſay the plant receives no nouriſhment from the earth. Many have been the experiments of raiſing plants, ſhrubs and trees in boxes filled with earth, and this earth being weighed after the ſhrub or tree had grown to maturity, (as the orange and lemon tree) and after taking out the tree the dirt is not found to have loſt any of its weight: it thence follows that the earth is only a bed to hold up the plant or tree, that it may receive its nouriſhment from ſome other ſource; and the difference between good land and poor land, conſiſts only in the poſition of its parts ſo as to enable the plant or tree to receive nouriſhment from a different reſource, better in the one, than in the other, although neither afford any themſelves. The next enquiry will then be, What is the food of plants? and the laſt, By what means this nouriſhment is received? If we leave out earth, there will remain only the two elements, water* and air, that can afford the nouriſhment neceſſary for the food and growth of the vegetable creation: for it is ſuppoſed in this theory, that manures of any kind afford no nouriſhment to the plant, but only anſwer the purpoſe of altering thoſe parts of the earth in ſuch manner as are beſt calculated for the extention of roots, and reception of the water and air, or by attractions of ſuch parts of the atmoſphere as are food for plants, or by the emiſſion of fixed and other air, of which they are peculiarly poſſeſſed, add to vegetation. If we ſuppoſe as ſome philoſophers have lately endeavored to prove, that water is formed from air, and of which there appears to be great probability, there will then be in fact nothing but air in ſome ſhape or other, from which vegetables can derive their ſubſiſtence. But at this we ſhall not be ſurprized, when we conſider the at-

* As a ſmall proportion of earth is found in all water, and a ſmall proportion of earth in all plants, being analyzed, it is not deſigned to exclude this earth in all water from the nouriſhment of plants.

moſphere as a vaſt laboratory, in which nature, as the operator, performs immenſe productions of various kinds, ſuitable for the nouriſhment of every ſpecies of the vegetable creation, and is the grand receiver in which the decompoſition of all bodies, and the various kinds of air ariſing from them are received, mingled, combined and ſeparated, not by chance, but by infinite power and wiſdom. Chymiſts are agreed in one general opinion, which has been ſatisfactorily proved, that ſuppoſing the air in general, or atmoſperic air, to conſiſt of one hundred parts, only about twenty-eight of thoſe parts principally adapted to the ſupport of animal life, the other parts are the nouriſhment of vegetables. We ſee vegetables grow more rapidly in cities than in the country, which confirms this theory, as in cities the air has a greater proportion of putrefaction, conſequently more of that kind of air ſuitable to the growth of vegetables, than in the country; we further obſerved where a compoſt is made of putrefying ſubſtances as fiſh for inſtance, vegetables at a diſtance from the heap of compoſt grow luxuriantly, which muſt be from the putrefied air proceeding from the compoſt, and abſorbed by the leaves or blades of the vegetables. We frequently ſee in flower pots the hyacynth and other vegetables growing rapidly and coming to perfection, ſupported by the mouth of the flower pot, the pots being filled with water only, in which we ſee the roots extending and growing in proportion to the ſtalks, leaves and flowers; here the plant receives all its nouriſhment from the air and water imbibed by the roots and branches. The ſedum anacampſeros, or evergreen, too, we frequently ſee hung up by a thread, growing very well without any water, and nouriſhed only by the air. It cannot be thought more ſtrange that the air ſhould change into a plant, ſhrub or tree, or any other body, than that they ſhould be decompounded and return to air again.

This we ſee performed every day ; for inſtance, the candle by which I now write is continually diminiſhing and returning to the great reſevoir of nature, and then being worked up will become the food of vegetables, which being eat by the ox, becomes part of his tallow, and being made into candles, may at a future period afford me light to write a ſecond time. If our theory be true, it follows that all vegetables are produced in their great variety by the different combinations or kinds of air which the chymiſts of the preſent day would call *inflammable* air, *fixed* air, *vital* or *pure* air, and *mephitic* or *impure* air. Theſe different airs being combined in the different vegetable organic ſtrainers, in a maner yet inexplicable, compoſes their different ſubſtances, and ſupports them in their vegetation, growth and propagation. By ſome late experiments it appears, that fixed air, called by chymiſts carbonic gas, and is the ſame air which makes beer or cider foam when poured out of a bottle into a glaſs, or the ſame which makes emptings or yeaſt raiſe the flour, or the ſprings of Saratoga and Ballſtown do the ſame, is very favorable to vegetation. Aſhes has a very powerful effect, in the ſouthern parts of the ſtate, as a manure, although it is not a putrefied ſubſtance. The ſalts of the aſhes, called by chymiſts, alkali, have the power of attracting the nitrous air from the atmoſphere in great abundance. This is ſeen by boiling water leached from earth taken from covered places, where as ſoon as you add a little lye from aſhes, the nitre, which before adhered to the earthy parts in the water, immediately diſengages itſelf from the earthy parts ſuſpended in the water, and adheres to the lye, which makes the ſalt petre we uſe, and which is one of the moſt powerful manures. Again, if a heap of dirt is put under cover and frequently ſprinkled with lye, the attraction of nitre from the atmoſphere will be ſo great, that in a ſhort time the heap will be covered with nitre, in

appearance to hoar froſt. This nitre is part of the air, and being found by experience to be good manure, muſt be part of the vegetable production, which when decompounded, or becoming diſſolved by putrefaction or otherwiſe, returns again into the air. The fixed air eſcaping from all fermented vegetable ſubſtances, as well as from thoſe which are in a putrefying ſtate, ſhew that fixed air compoſed a conſiderable part of their ſubſtances, and conſequently muſt be one of the firſt manures. If we extend our ideas a little further, and conſider that all fleſh is graſs, as the inſpired writer expreſſes it, and may be literally true, we may ſafely conclude, that all animals as well as vegetables, are compoſed of air and water. The graſs is nouriſhed and comes to perfection by theſe elements, the ox eats the graſs, and the man not only eats the ox, but vegetables alſo, and by the various organizations of the plant, the ox, and the man, their different ſubſtances are produced, being originally from the air and water. Dr. Prieſtly, by his important diſcoveries, has greatly added to the knowledge of analyzing the air, which is found capable of being divided and ſeparated in all its different parts, and has become a great ſource of uſeful knowledge to the world. Phyſic has been greatly improved by theſe late diſcoveries, and by it perſons have been reſtored to health, as by miracle. The philoſophic mind has been delighted in the experiments, and in contemplating thoſe marvellous works of nature which are upheld and directed by infinite power and wiſdom. The agricultural intereſt too daily experiences the beneficial effects of theſe diſcoveries, in procuring manures, by which ſubſiſtence for man is afforded from old and worn out fields.

On the Effects of OXYGENE, *in accelerating the Germination of Seeds, communicated in a Letter to Simeon De Witt, Esq. by* ROBERT R. LIVINGSTON, *President.*

DEAR SIR,

I ENCLOSE you a very important discovery of the German chymists; you will easily see the great advantage that will result from it, not only in the introduction of foreign plants, the seeds of which seldom vegetate, but even in common agriculture; in that of Indian corn more particularly, which, from not vegetating soon, is frequently destroyed by birds and insects, as well as injured by lying in the earth. It will be peculiarly proper to lay before the society, as it will convince them of the connexion that exists between chemistry and agriculture.

On the effects of Oxygene in accelerating Germination.

[From the Journal de Physique, 1798.]

"Mr. HUMBOLDT discovered, in 1793, that simple metallic substances are unfavorable to the germination of plants, and that metallic oxydes favor it in proportion to their degree of oxidation. This discovery induced him to search for a substance with which oxygene might be so weakly combined as to be easily separated, and he made choice of oxygenated muriatic acid gas, mixed with water. Cresses (lepidium sativum) in the oxygenated, muriatic acid, shewed germs at the end of six hours, and in common water at the end of thirty-two hours. The action of the first fluid on the vegetable fibres is announced by an enormous quantity of air-bubbles, which cover the seeds, a phenomenon not exhibited by water till at the end of from 30 to 45 minutes. These experiments, announced in Humboldt's Flora, and in his Aphorisms on the Chemical Physiology of plants, have been repeated by others; they were made at a temperature of from 12 to 15, Reaumur. In the summer of 1796, Humbolt began a new se-

ries of experiments, and found that by joining the ſtimulus of caloric to that of oxygene, he was enabled ſtill more to accelerate the progreſs of vegetation. He took the ſeeds of garden creſſes, peas, French beans, garden lettuce, mignonette, equal quantities of which were thrown into pure water, and the oxygenated muriatic acid at a temperature of 88° Farenheit. Creſſes exhibited germs in three hours in the oxygenated, muriatic acid, while none were ſeen in water till the end of 26 hours. In the muriatic, nitric, or ſulphuric acid, pure or mixed with water, there was no germ at all; the oxygene ſeemed there to be too intimately united with the baſes of azote or ſulphur to be diſengaged by the affinities preſented by the fibres of the vegetable. The author announces that his diſcoveries may one day be of great benefit in the cultivation of plants. His experiments have been repeated with great induſtry and zeal by ſeveral diſtinguiſhed philoſophers. Profeſſor Pohl, at Dreſden, cauſed to germinate in oxygenated, muriatic acid, the ſeed of a new kind of euphorbia, taken from Bocconi's collection of dried plants, 110 or 120 years old. Jacquin and Vandet Schott, at Vienna, threw into oxygenated, muriatic acid, all the old ſeeds which had been kept 20 or 30 years at the botanical garden, every attempt to produce vegetation in which had been fruitleſs, and the greater part of them were ſtimulated with ſucceſs: even the hardeſt ſeeds yielded to this agent. Among thoſe which germinated were the yellow bonduc or nickar tree (guilandina bonduc,) the pigeon cytiſus (cytiſus cajan,) the dodonœa anguſtifolia, the climbing mimoſa (mimoſa ſcandans,) and new kinds of the homacæ. There are now ſhewn at Vienna very valuable plants which are entirely owing to the oxygenated, muriatic acid, and which are at preſent from five to eight inches in height. Humboldt cauſed to germinate the cluſia roſea, the ſeeds of which had been brought from the Bahama Iſlands by Booſe, and

which before had reſiſted every effort to make them vegetate; for this purpoſe he employed a new proceſs, which ſeems likely to be much eaſier for gardeners who have not an opportunity of procuring the oxygenated, muriatic acid: he formed a paſte by mixing the ſeeds with the black oxyde of manganeſe, and then poured over it the muriatic acid, diluted with water. Three cubic inches of water were mixed with half a cubic inch of the muriatic acid; the veſſel which contains this mixture muſt be covered, but not cloſely ſhut, elſe it might readily burſt. At the temperature of 95° the muriatic acid becomes ſtrongly oxydated, the oxygenated, muriatic gas, which is diſengaged, paſſes through the ſeeds, and it is during this paſſage that irritation of the vegetable fibres takes place."

On the Effects of NITRE, *or* SALT-PETRE, *in promoting the Growth of Corn and Wheat. By* ROBERT JOHNSON, *Eſq.*

IT is a remark which we know by ſad experience to be true, that a great body of the lands in this country, that have been a long time under cultivation, are in a conſtant ſtate of depreciation, with regard to raiſing wheat. It then behoves us to endeavor to look out for ſome ſubſtitute to ſupply the deficiency. Among the different kinds of grain that claim our attention and ſeem to promiſe the greateſt ſupply, there are none equal I think to Indian corn. This grain will grow as well on old land, if manured and well cultivated, as on new; and every attempt to render a crop of this grain luxuriant and profitable, ſhould be embraced with the greateſt avidity. The method of cultivating this grain is ſo well known, it is needleſs to ſay any thing about it, I would only give ſome directions in preparing the ſeed which from

experience I have found to be uſeful: Take three ounces of ſalt-petre, bruiſe it fine, and diſſolve it in as much ſoft or brook water as will immerſe one half buſhel of corn, to which add one pint of ſtrong lye; ſteep the corn in this liquor before planting, 20 hours, then ſpread it on a dry floor about five or ſix hours, when it will be fit to plant. I make no doubt but this treatment would be uſeful to ſeed wheat or other grain, and ſhall here relate an experiment I made about two years paſt. Late in the fall a neighbor of mine being at my houſe was lamenting that he had met with ſome embarraſſment that had prevented him from ſowing part of his crop of wheat in proper time; I told him if he would follow my directions, I would engage the wheat he would now ſow, would be as forward in growth as what he had ſown a fortnight paſt. He promiſed to follow whatever I would preſcribe; and I gave him as much ſalt-petre as was ſufficient for what wheat he had to ſow, enjoining him at the ſame time to give me an accurate account of the ſucceſs of his crop. About the time his wheat was fit to reap, he came and told me the wheat he had ſown by my directions, was on the ſame kind of ground his other wheat was ſowed on; that it was ſooner ripe; that it grew four inches longer than what he had ſown early, and was at leaſt 25 per cent. better.

ON STOCK.

On the advantages of Domeſticating the Elk and the Mooſe; by ROBERT R. LIVINGSTON, L. L. D. *Preſident of the Society.*

IT is commonly alledged, that nature in every climate habitable by man, has placed within his

reach animals capable of being domeſticated and rendered ſubſervient to his wants. Aſia and Africa, which contain at once the moſt ſterile and the moſt fruitful climates, have been moſt liberally ſupplied with animals fitted for both. The horſe, the aſs, the camel, dromedary and buffaloe, have been ſubmitted to their ſway; nor has even the lordly elephant been able to withdraw his back from the burden. Thus plentifully provided, the zebra appears to have retained its native wildneſs. Time and the civilization of the Africans, will probably reduce that and the towering giraffe to ſubmiſſion. The temperate climates of Europe, I believe, can only claim the bull, while the frigid zone of Europe and Aſia is ſupplied with the rein-deer. The various climates of our extended continent have not been neglected: in the ſouth, the lama or Peruvian ſheep, but more properly camel, has long ſince bowed under the yoke: the temperate parts of America are furniſhed with the biſon and the elk; while the cold, moiſt climates on the ſoutheaſt are poſſeſſed of the mooſe. No attempts have been made to render theſe noble animals uſeful: content with ſacrificing them to our hunger, we have never thought of drawing from their activity and ſtrength the aids which they might afford us by their labor. The elk is larger than the rein-deer, and when taken young as domeſtic as the ox, as I find from having three that run with my cattle, and appear as much attached to them as to their own ſpecies. I have lately attempted to break two of them to the harneſs, and am much encouraged by my firſt eſſay; they have been but twice bitted, and appear to me to be quite as docile as colts would be at their age. They apply their whole ſtrength to the draught, and go on a ſteady pace. Their mouths appear to be very tender, and ſome care is neceſſary to prevent their being injured by the bit. Mine are about two years old, and are not leſs than 13 hands high; their thighs are as muſcu-

lar as thoſe of a horſe; in their native woods the males grow to about 15 hands, as far as I can collect from the information of hunters. It is probable, however, that in a ſtate of domeſticity they would grow much larger, as all gramenivorous animals are pinched for food in our climate during the winter. Their gaits are a walk and a trot, they never bound like the ſtag. If upon trial it is found that the elk can be rendered uſeful in the harneſs, it would in many views be an acquiſition; as its trot is very rapid, it is probable that in light carriages it would out-travel the horſe. The rein deer affords abundance of rich milk, it is not to be doubted that the animal which is only a larger ſpecies of rein deer might be brought to furniſh our dairies; it appears to me to be leſs delicate in its food than a horſe, mine have been kept fat on hay alone, though they were very negligently attended. They are long lived and more productive than any domeſtic beaſt of burden, generally producing two fawns at a birth. By caſtration they may be prevented from getting horns, if, as I ſuppoſe, their enormous ſize ſhould be conſidered as inconvenient, it is probable too that the ſuperabundant nutriment which is annually expended upon the horns, would in that caſe add to the bulk of the body. But whatever may be the deficiency of power in the elk, I am well ſatisfied that unleſs we except the horſe, no animal is ſo well fitted for every purpoſe of labor as the mooſe: I have ſeen one lately that did not exceed 18 months old, that was full 15½ hands high, and muſcular in proportion to his height. Suppoſing this animal to grow in the ſame proportion as a horſe, I have little doubt of his exceeding twenty hands if well fed. I have been told by a hunter, that he has meaſured one that had been killed, that was eight feet or 24 hands high; I think Goldſmith ſays upon ſimilar authority, that they are upwards of 20 hands; while Pennant reduces them to 17. An animal that only lives in very

cold climates (for I believe they are ſeldom found farther ſouth than the 44th degree of latitude) muſt, during the winter, ſuffer extremely, and have its growth diminiſhed. I ſhould not at all be ſurpriſed if the mooſe ſhould, when reduced to a ſtate of domeſticity, reach ten feet in height. Of this we may form ſome judgment, by obſerving the difference between the cattle and horſes that are ſuffered to run wild, to the ſouthward, and thoſe kept conſtantly in their paſtures. Its advantages would be ſtrength, hardineſs, agility, utility for food, and for the dairy; thus uniting together in one animal, all the advantages of the ox and the horſe: we muſt, however, except beauty, for few animals have a more uncouth appearance; the head is out of all proportion large, the neck ſhorter than the head, the body much ſhorter compared to its height than that of either horſe or ox; perhaps it may be leſs ſo in the full grown mooſe, than in the one I ſaw; the tail, if it may be ſo called, is a broad, ſhort flap, that hardly covers the anus, ſo that its only defence againſt flies, muſt be the thickneſs of the hide and hair; the colour of the latter is a dark brown, approaching to black, intermixed with ſome gray hairs; his horns were juſt beginning to ſprout, ſo that I cannot deſcribe them; they are ſaid to be when full grown, palmated, and large in proportion to the animal. It were much to be wiſhed that ſome trial were made as to the domeſtic uſes in which this animal may be employed, and the rather as its range in the creation is ſo extremely ſmall (being confined to America, and there only to about ten degrees of latitude, and ſtill fewer of longitude) that there is reaſon to apprehend their entire extinction as the country ſettles; and the rather as they herd in the winter, in droves of 18 or 20 together, return to the ſame ſpot at night, and when the ſnows are deep and encruſted, ſuffer themſelves to be killed without moving from the place they have trampled.

On improving the Breed of Horned Cattle, Sheep and Hogs; by EZRA L'HOMMEDIEU, *Esq. Vice-President of the Society.*

IT has been an old obſervation of farmers, that a breed will run out, by which is meant, that horſes, cattle, ſheep and hogs being kept long without changing or croſſing the breed, will dwindle away and become very poor. Too little attention is paid in this country and eſpecially in this ſtate, to the utility of a farmer's often changing his bulls, rams and boars. I know a farmer who kept one breed of hogs ſo long that his pigs appeared paralitic, and could not get over a rail on the ground till they were a fortnight old; on changing his boar his pigs were healthy, and from the ſame number of hogs fatted, he killed a third more pork than he did before the breed was croſſed. I am happy to learn that many farmers in this ſtate are improving their breed of cattle; Mr. Eaton a few years ago brought from England a bull and two or three heifers; this breed of cattle has ſpread conſiderably, and have made the ſtocks of cattle much better where they have gone; a gentleman in Dutcheſs county, Major Clift, a member in Aſſembly from that county, who is in the breed of that ſtock of cattle, ſold a bull laſt year for 300 dollars, and two half blooded bull calves after weaning for 50 dollars each, and the laſt ſeaſon had five dollars for the bull's going to a cow. In this way the breed of cattle will ſoon be improved, becauſe farmers will carry their beſt cows to the bull, when they have ſo much to pay for his uſe; and what is of further advantage, when a farmer has a calf from ſuch a bull and cow, he pays more care to raiſing it, than he does to his common ſtock; this too is the caſe with a new ſtock of ſheep or ſwine. We are ſurpriſed at the great expence farmers in England are at to improve their breed of cattle, ſheep and hogs. Perhaps it will not be amiſs to give

ſome late inſtances of the ſpirit with which the farmers in that old country (which has ſo long been improving in huſbandry) are now poſſeſſed of in improving their breed of cattle, ſheep and hogs. The long horned breed are now in the higheſt eſtimation in England, which will appear by the following particulars of Mr. Paget's ſale, in November 14, 1793, as publiſhed in the Engliſh books of agriculture :

Firſt Day's Sale.

Lot		Guineas.
8.	Short Tail, by Shakeſpear, bought at Mr. Fowler's	38
9.	Eyebright	51
14.	Strawberry, by a Diſhley bull	31
16.	Brindled Eyebright	33
26.	Penn	35
29.	Young Dandy	30
30.	Brindled finch-tidy	29
34.	Shakeſpear (bred by the late Mr. Fowler) by Shakeſpear, off Young Nell; whoever buys this lot the ſeller makes it a condition that he ſhall have the privilege of having two cows bulled by him yearly	400
35.	Bull calf, by lot 34	23
37.	A ditto, by ditto	31
39.	A ditto, by ditto	31

Second Day's Sale.

45.	One three year old heifer	70
47.	One do. do.	32
48.	One do. do.	35
52.	One do. do.	35
55.	One two year old heifer	25
57.	One do. do.	60
58.	One do. do.	84
60.	One do. do.	29
61.	One do. do.	25
64.	One do. do.	27

The breed of ſheep moſt in eſtimation in England, are a breed called the Diſkley breed. The leading

idea is to procure that breed, which, on a given quantity and quality of food, will pay the moſt; and it is ſuppoſed that this breed will live when many other breeds would ſtarve; and that the more beautiful the form, the hardier the animal is of every kind. Nothing can ſhew the high eſtimation this breed is held in clearer, than the high prices they have fetched lately at different ſales; the following are ſome of the particulars of Mr. Paget's:

Ewes belonging to Thomas Paget, Eſq. ſold by auction November 16, 1793, by Mr. Boott.

Lot.	Ewes.	Guineas each.	Guineas.	
6	5	62	310	Mr. Buckley
38	5	52	260	Mr. Pelkenton
37	5	45	225	Ditto
5	5	30	150	Mr. Breedon
17	5	30	150	Mr. S. Stone
7	5	29	145	Mr. Bennett
11	5	25	125	Ditto
3	5	22	110	Mr. S. Stone
9	5	22	110	Mr. Boyer
2	5	20	100	Mr. Stubens
4	5	20	100	Mr. Tomelin
14	5	20	100	Mr. Fryer
15	5	20	100	Mr. Deverill
18	5	20	100	Mr. Martin
20	5	20	100	Lord Egremont
16	5	18	90	Mr. Wingfield
40	5	17	85	Mr. Molard
12	5	16	80	Mr. Powriſe
23	5	16	80	Lord Egremont
39	5	16	80	Lord Harborough

By private contract before the ſale, 30 ewes at 20 guineas each, 600 guineas, Mr. Simpſon.

It is wonderful that 130 ewes ſhould fetch an average of 25 guineas, and all of them the property of one man. In the third volume of John Monk's agricultural dictionary, publiſhed in 1794, there is

an account that Richard Aſhley has a very fine ſort of ſwine, which he ſends to different parts of England, the boars to ſerve ſows at half a guinea each, and Mr. Bakewell, in order to make people particular in ſending good ſows, wiſhes Mr. Aſhley to increaſe the price to a guinea; the produce Mr. Aſhley ſells (for breeding) at five guineas each, weaning old and barrow pigs at one guinea; they are very broad over the back, with very little offal, and have a great propenſity to fatten; the boar is thought to be very much like the wild boar. Mr. Biſhop of the Three Towns Inn, Leiceſter, has a very handſome ſow, the produce of which he ſells at two guineas each, weaning old.

ARTS AND MANUFACTURES.

Improvements on the Steam Engine, communicated to the Society in January, 1798, by R. R. LIVINGSTON, *Eſq. and contained in a Letter from him to Thomas Jefferſon, Eſq.*

January 1799.

"PHYSICS and mechanics never formed a nobler union than in the invention of the ſteam engine, which at once ſubjects the moſt powerful and the moſt common agents to man; he repoſes at eaſe while fire, air and water perform his laborious taſks. The ſlow ſteps by which this engine has advanced to its preſent ſtate of improvement, are really aſtoniſhing, conſidering how naturally moſt of thoſe improvements ſuggeſt themſelves; even now it appears to me very imperfect. The firſt defect is the want of ſimplicity in the conſtruction, where the object is only to raiſe water to no very great height, as in draining marſhes, freeing dry docks and ſlips from water; and it would be very deſirable in ſuch caſes to have an engine ſo conſtructed, as to coſt lit-

tle and not require the care and attention of an artiſt. The ſecond defect of the moſt approved engine (Dr. Watt's) is the loſs of power, occaſioned by the friction; the dry piſton and working rod exhauſt near one-third of the groſs power. When to this is added the oppoſition the air gives to his air pumps, their friction, and that of the freeing pump when water is raiſed, it will be found that one half of the power is loſt when his engine acts to moſt advantage, to wit, in raiſing water. It is ſtill more defective when applied to obtain a circular motion; this it effects either by a winch, or planet wheels, the latter he prefers; in this caſe ſuppoſing the power two thouſand one hundred, one-third loſt in the friction, about one hundred pound in the friction of the air pump (excluſive of the oppoſition of the atmoſphere) the friction and vis enertiæ of the weighty beam would leave about twelve hundred pound to apply to the planet wheel, whoſe friction cannot be leſs than one quarter of that weight. But as in every revolution there are two points on which the wheels do not act, but depend on the fly to carry them paſt, and only two other points on which the machine acts at right angles, the mean between o and nine hundred is the whole power directly applied to obtain a circular motion; or in other words, a groſs power of two thouſand one hundred pound is reduced to four hundred and fifty pound when applied to turn a wheel. I have attempted to remedy theſe defects in Dr. Watt's engine; with what ſucceſs, you will judge, when I explain my principles, and examine the rough ſketches I encloſe.

Firſt, to obtain a ſimple engine, and one that can be erected at a trivial expenſe: Take a box or hogſhead of wood of ſufficient ſtrength, connect this with a tube of wood which is to ſerve as a pump, and is immerſed in water; at the height of twenty feet, or any leſs height to which the water is to be raiſed; let there be a wide chamber fitted to hold ſo

much water as is to be diſcharged at every lift; into this a valve muſt open from the lower or narrow part of the pump; from this chamber a narrow pipe leads into the box or cylinder furniſhed with a valve that opens into it, this muſt be placed ſo high that no water can get into the cylinder; from the lower part of the pump-chamber runs the nozel or ſpout, furniſhed with a valve that opens outward, which while there is a vacuum in the pump, will be kept cloſe by the preſſure of the external air, but when the air is admitted in the pump will be forced open by the preſſure of the water. On the top of the pump place a valve with ſuch a cock as will keep open till the water runs out, and cloſe when the condenſing water enters the cylinder; the opening of this cock will force the water to run from the ſpout; the cylinder muſt be furniſhed with the uſual valves through which the air and condenſed water are to be expelled, a ſteam cock and condenſing cock; the water for condenſing to be taken from the pump, for which purpoſe a ſmall chamber ſhould be annexed to the pump, ſo low that the water will not be diſcharged when the pump is emptied, into which the condenſing pipe is to be inſerted. Theſe ſeveral cocks may be worked by hand, by floats, by the water raiſed (as in the encloſed plan) or by a ſmall atmoſpheric engine on the top of the cylinder and communicating with it. Suppoſe the hogſhead or cylinder to contain thirty feet (which is about equal to a twenty-eight inch cylinder, making ſix feet ſtrokes) and the pump-chamber ten; when a vacuum is made in the cylinder the air will ruſh into it from the pump to ſupply its place; that is to ſay, the air which before occupied ten feet will now forty, and of courſe be three quarters lighter than the external air, and the water will riſe about twenty-four feet in the pump. When the ſteam is again let into the cylinder the valve of communication muſt cloſe, and the cock on

the top of the pump open, which forces open the valve on the nozel of the pump and drives the water out; thus at every ſtroke ten cubic feet of water will be raiſed upwards of 20 feet. If it is deſired to raiſe it to a greater height, it may be done by enlarging the relative proportions of the cylinder and pumps, and working ſeveral pumps at once; the upper pumps taking the water from the chambers or reſervoirs of the lower one, and all of them communicating by narrow channels or pipes with the cylinder. It is true that this engine waſtes ſome ſteam, becauſe the vacuum is only the difference between the contents of the cylinder and the chamber of the pump, which we have ſuppoſed in this inſtance to be three-fourths. But Dr. Watts's engine loſes 1-3 in friction, 1-8 in his air pump, and 1-4 of the remaining power in the friction of the forcing pumps, beſides the vis enertiæ of his beam, fly, chains, &c. ſo that in fuel this ſimple engine requires leſs ſteam to do the ſame work. As the cylinder is of wood, and may be lined and covered with blankets or mats, or any other non-conductor, it will be kept nearly of the temperature of the ſteam. The air which is admitted being a bad conductor of heat, can carry off very little; the condenſing water will be the only active agent for this purpoſe; but as wood parts with its heat very reluctantly, much leſs will be loſt in this way than in Newcomb's engine, though perhaps, more than in Dr. Watts's. You will obſerve, that as the ſteam is only uſed to expel the air from the cylinder, the water need not be more than boiling hot, ſo that no extraordinary ſtrength is neceſſary in the boiler, as in Dr. Watts's where the preſſure of the ſteam is equal to 4 lb. upon an inch more than that of the atmoſphere. To loſe leſs heat and ſave ſome money, I prefer a boiler of wood to one of copper, placing the furnace in the centre, and bringing the chimney out at the mouth of the furnace, ſo that the water ſurrounds both chimney and furnace. I

have found on experiment with a boiler ſo conſtructed, that when the ſteam is ſo hot as to raiſe a weight on the valves of 4 lb. upon a ſquare inch, that you may lay the back of your hand againſt the boiler without the leaſt inconvenience.

That I may not engroſs too much of your time at one period, I ſhall defer till another opportunity my deſcription of an engine, in which I think I have the full power of Dr. Watts's, without loſing any by the friction of the piſton, working rod, or air pumps, having contrived the whole machinery to work without friction, or with ſo very little as not to be taken into account: and alſo, of another, in which the whole power can be directly applied to obtain a circular motion, without winch or planet wheels. Prudence bids me to afford you an opportunity of detecting the faults of this before I expoſe a ſecond theory to your critical inſpection.

A new Diſcovery relative to the Art of Manufacturing PAPER; *communicated in a Letter to* S. DE WITT, *Eſq. dated Clermont, September* 8, 1799.

By Chancellor LIVINGSTON, *Preſident.*

THE object of this letter is principally to introduce to your notice ſome ſamples of paper, made by my direction, from a material of my own invention. If you have ever attended to the ſubject, you muſt have found that the great and increaſing conſumption of paper, had rendered it an object to find ſome material cheaper than linen rags.—Though many of the moſt ingenious men in Europe have given great attention to this ſubject, for fifty years paſt, in many inſtances with the aid of government, they have hitherto been unſucceſsful; for though their experiments have taught us that the inner bark of ſome trees, and certain plants, as net-

tles, thiſtles, hop-vines, &c. will make paper, yet the difficulty of procuring them in ſufficient quantity, and the expenſe of preparing them, has rather rendered their diſcovery matter of curioſity, than utility. After amuſing myſelf with ſome experiments in this line, it ſtruck me about ten years ſince that a plant (which I take to be of the conferva kind) extremely common on Hudſon's river, might be advantageouſly applied to this uſe. Upon examining, however, into the attempts made by the French philoſophers, with every advantage at their paper-mills, I found that they could not reduce their conferva to a paſte; from whence they concluded that its particles were round, and only adhered by attraction, aided by a glutinous ſubſtance; while others aſſerted that the conferva was not a plant, but a collection of animals. I found too that they had been equally unſucceſsful with the alga marina: this kept me for ſome time from working upon the conferva of our river, but not from recommending it to the owners of ſeveral paper-mills to make the trial, which they might do at the moſt trivial expenſe. The hint, however, was diſregarded, and its author probably looked upon as a viſionary, who was offering his dreams for realities. Finding no one ſufficiently credulous to reduce my theory to practice, I at length ſet about the work myſelf, and by the aid of a marble mortar, a punch ſieve, and a bit of canvaſs, with ſome of the moſt ponderous folios from my library for a preſs, I began my labors. I found on the firſt trial, with more pleaſure than ſurprize, (for my impreſſions in favor of its practicability were very ſtrong) that it was converted into paper with much leſs labor than rags are; that it turned out of the mould (or punch ſieve) with great facility. The next object was to get rid of a number of ſmall ſnails and other aquatic inſects that bred in it; this I did by precipitating it in a diluted vitriolic acid, or uſing allum, which alſo whitened the paper; this having

been neglected in the paper ſent you, occaſioned the black ſpots you obſerve in it. But as in my trials I had no means of triturating the plant in running water, the pounding it in a mortar preſerved all the mucilage that it naturally contained, which rendered the paper brittle, when perfectly dry; but at the ſame time ſized it ſo perfectly, that you could not only write upon it with eaſe, but if a piece of filtering paper was laid over it and preſſed, the filtering paper would take the ink as well as the beſt writing paper. As I was ſatisfied that trituration in running water, or at leaſt a ſmall admixture of rags would take off the brittleneſs, I was not diſcouraged from proſecuting my plan.

I communicated my diſcovery to my neighbor, Mr. Delabigarre, and he entered very heartily into it, and made many experiments himſelf in conſequence of, and in confirmation of mine, and felt ſuch an intereſt in its ſucceſs, as to propoſe ſuperintending the firſt experiment that I propoſed to make at a paper-mill, at Catſkill, whither he went with 80 lb. of the material, all except about 15 lb. of which had been dried in the ſun. When he arrived he found great difficulty in perſuading the workmen to make the experiment, which they conſidered as hopeleſs. Having by dint of arguments and brandy, overcome their prejudices, they conſented to make the attempt; but as their veſſels were too large for the quantity of materials brought them, and as he wiſhed at all events to cover himſelf (though it were with rags and tatters) from the ridicule that awaited him, a number of perſons attending to ſee the experiment, he propoſed to add one quarter of coarſe rags. The maſter-workman, however, preferred only adding ten pound of rags, or 1-9. Before he had given it half the trituration uſual with rags, he found the paſte perfect, and upon trying it he was ſurprized to find that it came off from the mould quicker and cleaner than linen rags, ſo that much

more may be worked in the ſame time. Mr. Delabigarre not having leiſure to wait the uſual proceſs of preſſing, drying, &c. brought away a quantity (of which the ſamples I ſend you are part) haſtily dried over the fire. The wrapping paper you will find ſuperior to that made of rags. The hanging paper is better than the Engliſh paper commonly applied to that uſe, and I am perſuaded from the texture of the material, that when ſufficiently waſhed, fine paper may be made of it. But ſhould it not, the demand for the ſorts now ſent you, and for ſheathing paper, would render the diſcovery very important. The want of materials has hitherto kept our mills from being ſufficiently employed, and thoſe materials together with great quantities of paper are annually imported. My material is ſo abundant in Hudſon's river during the ſummer months, that two men may procure as much as two or three tons in a day, and ſhould it be equally plenty in other rivers and not be found of the ſame quality elſewhere, I am perſuaded that we may not only ſupply America but Europe with paper, as well as give facility to thoſe manufactures that depend upon it, as paper-hanging, marbled paper, band-boxes, book-binding, &c. The ſamples I ſend you, you will make ſuch uſe of as may beſt ſerve to ſtimulate the purſuits of others toward objects that may, while they are uſeful to the inventor, be much more ſo to the community.

Extract from a Repreſentation made to the Legiſlature at its preſent Seſſion, on the Subject of Salted Beef, put up for Exportation.

FROM the beſt information that can be obtained, the moſt approved method of putting up beef in Ireland, is as follows, and is ſuch as is generally contracted for by the army and navy agents:

After the cattle are driven to the ſlaughter-houſe

yards, they ſtand a few days to cool (the time according to the diſtance they have driven) and are not killed until they are evidently clear of heat. After they are ſlaughtered and become cold, they are cut up in pieces of 6 or eight pounds; each piece paſſes through the hands of four or five men, who are placed at ſeparate troughs filled with ſalt, and every piece is rubbed by each of them with gloves having wooden palms, filled with nails with rough reads; the laſt rubber hands the piece to the packer who places it in a crib having a vat under it. This is what they term dry ſalting. The crib contains from ten to thirty barrels; the blood, &c. of the beef is thus drawn out and falls into the vats under the crib. After laying in the crib fourteen or ſixteen days, it is weighed and packed into barrels of 200 lb. each, with St. Ubes' ſalt (which is always preferred, not only from its giving the beef a fairer appearance, but as it has leſs tendency to harden the meat.) The liquor in the vats is cleanſed by boiling and mixed with the pickle and put into the barrels. About three pecks of ſalt are uſed to each barrel, with ſome ſalt-petre.

This care and method has given the Iriſh beef ſuch a decided preference at almoſt every place where ſalted proviſions are uſed; that many have ſuppoſed our paſtures were inſufficient to give the firmneſs and quality to beef as thoſe of Ireland; but from experiments made, we know that our beef of a ſuitable age, when properly fatted, packed and cured, is equal to any in the world.

In Ireland the packing of beef is made a particular buſineſs; in this country it is only a branch, and that often temporary; hence the perſon putting it up, too frequently has only the preſent ſeaſon in view; and therefore, although he may brand it with his own name, his intereſt often ſuperſedes a regard to his reputation, or to that of the article itſelf.

Our barrelled beef is too generally made of young

cattle, two or three years old, which will not bear the ſalt like old cattle—the ſalt will deſtroy the fat and extract the juice of the young, make it hard and give it a lean appearance; while the old will remain firm, yet tender, with a handſome look. Although the killing and packing young cattle is a circumſtance much againſt the reputation of our beef, yet the preſent mode purſued by our barrellers is ſtill more injurious; and as it is now become a conſiderable article of exportation, and under proper regulations might be greatly increaſed, much to the benefit of the huſbandman and the merchant; to remedy the firſt and promote the latter, further legiſlative attention is neceſſary.

The conceived intereſt of individuals has led them to adopt meaſures which have promiſed the greateſt immediate benefits to themſelves, and which under the preſent circumſtances of things, it is very difficult to make any legiſlative proviſion fully to prevent. Perhaps the beſt and moſt effectual ſtep that can now be taken, would be to encourage qualified perſons to engage in a buſineſs of this magnitude to themſelves and the ſtate, and to make a particular buſineſs of it; for it is by this method only our beef can gain a reputation at a foreign market equal to the Iriſh. But ſhould this encouragement be given, the neceſſity of further legiſlative proviſion yet remains to check exiſting evils.

A law was lately paſſed, directing all beef when repacked by any inſpector, to be pickled at the ſame time; that no beef ſhould be repacked till it had lain a ſufficient time in ſalt. However wiſe this law may be, the intention of it is evaded in ſeveral material points: the perſon who in the firſt inſtance puts up the beef, frequently makes proviſion at ſome landing, eſpecially if he lives at a diſtance, and when prepared, the cattle are driven there and immediately killed, often with a fever on them. As ſoon as cold, the beef is cut up in pieces very unequal, ſome

too ſmall, others often very large, ſo as to prevent the ſalt penetrating ſufficiently. It is then packed in tight barrels, which are generally filled with pickle immediately by the perſon putting it up, to prevent any diminution of weight, which it effectually does by diſſolving the ſalt, and thereby prevents its operation on the meat, in extracting the blood and juices, which the water prevents running off; or if it does not, the meat is immediately filled again with the water; from thence it is ſent to market; the repacker there, too often in the fall much hurried, weighs and repacks it without ſufficiently regarding or perhaps enquiring into its real ſituation, with reſpect to the time it has been in ſalt without pickle.

When beef is put up in this manner, without being dry ſalted and immediately pickled, when repacked it will taint, ſhould the pickle leak out, becauſe the blood and juices have not been previouſly drawn off, by placing it for a ſufficient time in a ſituation where ſalt alone will operate on the meat.

It is likewiſe very injurious for beef to be ſuffered to freeze before it is repacked, as is frequently the caſe in ſome places. Indeed when beef is thus put up, packed and pickled, though half a buſhel of ſalt be uſed to each barrel, yet by the time the warm ſeaſon comes on, the ſalt is generally diſſolved; the pickle then having nothing to feed on ſoon ſours, taints, and the beef is loſt. Hence we may account for the unuſual quantity of tainted beef in this city laſt ſeaſon, which probably had a principal influence in ſpreading and increaſing the calamity which attended us. The pickle being ſtarted in the ſtreet, expoſed to the action of the ſun, ſoon putrefied, and from the very conſiderable quantity ſo emptied, became highly offenſive. In ſome inſtances, to conceal the defects and avoid the cenſure, the bad pickle was ſtarted in the cellars, where it long continued to offend the neighborhood.

Another inconvenience attends this method of

putting up beef; though a temporary advantage may be derived by the individual, yet to the public it is ſeriouſly injurious: when beef is pickled as ſoon as packed, before the blood and juices are drawn forth, the pickle fills it in ſuch a way as to prevent the waſte and ſhrinking, that would otherwiſe take place, the loſs on ox beef being eſtimated at ſix to eight per cent. that on young cattle ten to fifteen per cent; all this loſs of weight is prevented by its being previouſly pickled. The beef when arrived at a diſtant market, and the pickle, through bad caſks, improper ſtorage, or rough handling in ſtowing, leaks out, the meat ſhrinks in conſequence, and the barrel often appears nearly one-fifth deficient in fullneſs; doubts ariſe in conſequence, not only as to its weight but as to its quality, by which the reputation of our beef is much impaired.

From the foregoing ſtatement, it is conceived highly neceſſary that more cloſe attention and care be given to this great and growing article of commerce, than it has hitherto received; not only as it regards the article itſelf, but alſo as it affects the health of this city; and it is conceived a law may be ſo framed as to anſwer both purpoſes; the firſt appears peculiarly requiſite, as from the frequent failure and growing uncertainty of wheat crops, many farmers are turning their attention more and more to grazing, from whence we may expect a very great increaſe in a few years; and as we can ſupply the article cheaper than any other country, we ſhould if it were placed under proper regulations, probably gain ſuch a credit as never to want a market. The like care, as it regards the health of the city, is equally neceſſary from the probable increaſe of the article.

After much reflection on this ſubject, the following has been thought the moſt efficacious method that can under all circumſtances be taken at preſent: That no beef be pickled until it has lain at leaſt fourteen days in a ſufficient quantity of ſalt, and

that where doubts ariſe, the repacker or inſpector have ſufficient authority to place it in ſuch a ſituation at the expence of the barreller; and that when in his opinion it ſhall be neceſſary, he uſe three pecks of ſalt to the barrel; that the pieces average as nearly 6 lb. as poſſible; that the number of inſpectors be diminiſhed and the price of repacking moderately increaſed; that a qualified perſon at the expenſe of the ſtate, be appointed to ſuperintend all the repackers in the city of New-York; that no beef be exported from thence but what is repacked therein; and that no proviſions be repacked within the city, in the months of July, Auguſt and September; and that no pickle at any time be ſtarted in the ſtreets, yards or cellars.

The ſuperintendant or inſpector-general ſhould alſo be inveſted with power, and it ſhould be made his duty to examine once a month at leaſt, and oftener if in his judgment it ſhould be requiſite during the warm months, all proviſions ſtored in the city, and to remove to a place of ſafety all ſuch as may appear to him in danger of ſpoiling or becoming injurious to the health of the inhabitants; the expences attending to be defrayed by the owners.

It is believed that beef when well put up in good caſks, well flagged and made tight, cured with a ſufficiency of ſalt, and the attention above mentioned, may remain in the city with as little danger to the health of the inhabitants as any other article of commerce.

This article will not bear much additional expenſe, and every burthen it is embarraſſed with in this, will tend to turn its courſe to the neighboring ſtates, from whence it will be very difficult to reclaim it. The foregoing obſervations are made reſpecting beef only; the preſent laws are conceived ample for pork, where the repacking is confined to judicious perſons.

Greater attention is alſo neceſſary as to the barrels

in which proviſions are packed, than has hitherto been given; it has long been an opinion and practice among coopers, that caſks or ſtaves of which the barrels are made, which will not anſwer for liquors, are good enough for proviſions: this idea is erroneous, and the practice has been productive of much miſchief. If a gallon of liquor leak out, the reſt will remain of the ſame quality; but if the ſame quantity leak out of a barrel of proviſions, the whole will be expoſed to taint or ruſt, and is always injured thereby. A caſk of twenty-nine gallons will contain two hundred pounds of beef with convenience, and if the barrel is not preſſed full, the proviſions will be injured thereby.

Calculation of the Profits to be derived from the groſs Matter or Sediment of Whale Oil; in a Letter to the Secretary, from Mr. BENJAMIN FOLGER, *dated Hudſon, Nov.* 29, 1792.

RESPECTED FRIEND,

THY requeſt for the knowledge of the profits that may ariſe from the groſs matter or ſediment contained in common right whale oil, I here communicate with freedom, wiſhing thou to lay it before that noble ſociety for uſeful arts, which thou haſt the honor to be a member of. I take my ſet off from an average voyage of one ſhip in the Brazil fiſhery, which is one thouſand barrels (ſome have brought home fifteen hundred;) out of one thouſand barrels there is at leaſt two hundred and fifty barrels of groſs, thick matter; the oil ſtrained or preſſed from that is worth one dollar more in a barrel than the common oil, by reaſon of its being preſſed through cloſe, fine cloths.

Say ſhip Columbia 1000 barrels, at 52s. £2600.

Out of 250 barrels of this thick, groſs matter, I preſs or ſtrain out 200 barrels of pure, clean and thin oil, worth one dollar more per barrel than the common oil, at 3l.	£600
There remains in candle-ſtuff about 28lb. to each and every barrel, 7000lb. at 2/3 per lb. I ſay 2/3, ſperm candles is worth 3/9, white wax 4s. - - -	787
750 barrels ſold of the ſhip's oil at 52s. -	1950
	3337
Deduct intereſt of money and expenſes in manufacturing	200
	£3137

Profits by the diſcovery 500l. to one ſhip's voyage, not including the advantages that ariſe to workmen in the buſineſs.

I have made my eſtimation within reaſonable bounds; as to the price of the candles you are judges of, none as yet have gone to market; Dr. Mitchell has a ſample of them; I expect to make improvements on this manufactory; if it is worth your attention, pleaſe to ſend me a line. I will tranſmit to you regularly my improvements in this buſineſs.

Method of Diſtilling Ardent Spirits from Potatoes, with Obſervations; communicated by Mr. L'HOMMEDIEU.

"FEBRUARY 15, 1777. I ſet apart two Aberdeenſhire pecks of potatoes, which I found to be ſeventy-two pounds; the potatoes were boiled in a cauldron till they were brought to a ſoft pulpy ſtate; they were then bruiſed and made to paſs through a ſtraight riddle, along with ſome freſh water, the ſkins being kept back by the riddle, which

were thrown away. The pulp was then mixed with cold water, till the whole amounted to about twenty gallons, Engliſh; this was allowed to cool till it attained the ſame temperature as would be proper for mixing yeaſt with wort; when ſome yeaſt was put to it, as if it had been yeaſt to wort, from malt. In ten or twelve hours a fermentation began, which continued very briſkly for the ſpace of ten or twelve hours, but at the end of that time it began ſenſibly to abate; from which circumſtance I was afraid my experiment would fail; after waiting for ſometime, and in vain, warming it a little with a view to renew the fermentation, I determined to ſtir it briſkly, to ſee if it could be renewed by that means; this produced the deſired effect, and the ſame operation was renewed every day, and the fermentation continued to go on in a proper manner for a fortnight, at the end of this time the fermentation abated and could not be renewed by agitation or otherwiſe, and the liquor having been found upon trial to have acquired a kind of acid, ſlightly vinous taſte, was judged fit for diſtillation; it was then diſtilled with due caution, care having been taken to ſtir it in the ſtill until it began to boil, before the head of the ſtill was applied; and the fire was afterwards kept up ſo ſtrong as to keep it boiling briſkly till the whole was run over: this was intended to prevent the thick matter from ſubſiding to the bottom; for I was afraid that without this precaution it would have acquired a *ſtill-burnt* flavor; and I found by experience, in one inſtance, that this kind of empyreuma was of an exceeding diſagreeable kind, reſembling in flavor the fumes of burning tobacco. In conſequence of theſe precautions, and due rectification, I obtained an Engliſh gallon of a pure ſpirit, conſiderably above proof, and about a quart more of a weaker kind, a good deal below proof. This was in every reſpect the fineſt and moſt agreeable vinous ſpirit I ever ſaw; in taſte it ſomewhat reſembled very fine

brandy; but it was more mild than any brandy I ever taſted, and had a certain kind of coolneſs upon the palate peculiar to itſelf, by which it might be readily diſtinguiſhed by a nice judge, from every other kind of ſpirit. Its flavor was ſtill more peculiar to itſelf; but it more nearly reſembled brandy, impregnated with the odor of violets and raſpberries, than any thing elſe to which I could compare it. A ſingle glaſs of it put into a bowl of punch, made it appear as if it had conſiſted half and half of rum and brandy, impregnated with the juice of raſpberries. It ſeemed to derive this flavor from a ſubtil eſſential oil, of a very ſingular kind; for although it aroſe with a freſh ſpirit that came over, it ſtill continued to come over, without any ſenſible diminution, or change of flavour, till the whole of the ſpirit was drawn off; it was alſo ſo difficult to be diſſipated, as to ſcent with its own perfume a drinking glaſs, into which the ſpirit had been poured, for more than twenty-four hours after it had been emptied, and apparently quite dry; and this perfume, after the ſpirituous flavor was totally diſſipated, appeared to me the moſt agreeable I had ever met with. I have been at the greater pains to deſcribe this kind of ſpirit in its ſtate of perfection, becauſe I have ſince heard of, and ſeen ſome ſpirits, ſaid to be drawn from potatoes, which for want of ſkill or caution in the operators was intolerably nauſeous." *Bath Papers*, vol. iv. p. 44, 1788.

Note. If ſeventy-two pounds of potatoes make five quarts of brandy, one hundred weight, which I ſuppoſe is about two buſhels, will make about ſeven quarts, which will be worth at leaſt ſeven ſhillings. Potatoes are raiſed in abundance in our new ſettled weſtern and northern country; three hundred buſhels to an acre is not uncommon, which being diſtilled, will produce one hundred and ſeventy-three gallons of brandy, which would be worth at leaſt eight ſhillings per gallon, and produce the ſum (in-

cluding the labor of diſtilling) of fifty-two pounds ſixteen ſhillings; the potatoes would not be worth more than two ſhillings per buſhel, as they are not an article of tranſportation. The difference then would be between the brandy and potatoes, twenty-two pound ten ſhillings; in many parts of the country they are worth raiſing at eighteen pence per buſhel; the difference then would be thirty pounds ſix ſhillings. Would it not be much for the intereſt of our new country, to make brandy from potatoes rather than from wheat or rye, which is ſo much wanted by the new ſettlers, and will bear a tranſportation to market, to enable the farmer to preſerve the neceſſaries he wants? and would it not be better for our old ſettled country to make their ſpirits from potatoes, rather than from apples, which would afford cider, which is more wholeſome and palatable than the ſpirits made from that fruit.

Experimental Eſſay on the Properties of the GALIUM TINCTORUM, *and its uſe in the Art of Dying; ſuppoſed to be the ſame which the Indians uſe in Dying their Porcupine Quills of a Red Colour. In a Letter to the Secretary.*

By JAMES WOODHOUSE, *M. D. of Philadelphia.*

Niſi quid utile facimus vilius alga eſt.

THE art of dying is an uſeful and important branch of manufactures; a permanent dye always doubles the value of wool, ſilk, cotton, or linen; for a faded coat or gown are generally thrown aſide, before they are half worn out.

Linnæus has placed this plant among the tetrandria monogynia, and with Profeſſor Kalm* has reckoned it a ſpecies of galium, and thus deſcribed it in his Species Plantarum.†

* Kalm's Travels, vol. iii. p. 14.

† Page 106, edition printed in 1753.

The galium tinctorum has ſix linear leaves on the ſtalk, and four on the branches; the ſtalk is flaccid, the peduncles are placed under the flowers, the ſeeds are ſmooth; the ſtalk of the plant is from ſix to eighteen inches high, the ſeed veſſel is on the top, and comes to maturity in September; the roots are from one inch to two feet long, and when dried, as ſlender as a common knitting-needle; the outſide of them is of a dark brown colour, the inſide when broken, of a yellow, orange or red colour. It grows plentifully in woods, ſwamps, and on the banks of rivers, in the middle and back parts of Pennſylvania, on the frontiers of the ſtate of New-York, in Canada, in the neighborhood of Hudſon's Bay, and in the Northweſtern Territory, about Port St. Vincents on the Wabaſh. Mr. William Bartram informed me, that ten years ago plenty of this vegetable might be found in a ſwamp, near the centre of the commons of Philadelphia. The roots of the plant ſhould be carefully dried in the ſun, and great precaution taken to preſerve them from moiſture, that they may not become mouldy, and be thereby rendered unfit for uſe.

The galium differs from the rubia tinctorum in the following particulars: the galium has little taſte, the madder is bitter; cold water, which has little action upon the galium, readily extracts the colouring particles of madder; more of the colouring particles of madder are waſhed from cloth, ſilk or linen, by cold water, than from the galium; the madder when boiled is not of ſo paſty a conſiſtence as the roots of the galium; the madder does not give ſo deep a red to cloth or ſilk as the galium. It agrees with the rubia tinctorum in two particulars, acids and alkalies have the ſame effect upon both.

John Reinhold Forſter, in a letter to Wm. Watſon, publiſhed in the 62d volume of the Philoſophical Tranſactions of London, ſpeaks of the galium, but has ſaid nothing ſatisfactory. M. Hellot, in a differ-

tation on the art of dying wool and woollen cloth, glances at it: he says there is a species of madder brought from Canada, the root of which is extremely slender, and produces nearly the same effect as the European madder.* Dr. Martin says, he has seen it flourish in such a manner in some situations, that several handfuls of it might be gathered in the compass of a yard or two.† Specimens of the dyed cloth and silk are sent to the agricultural society for inspection.

Experiment 1st. Cold water digested upon the powdered roots of the galium 24 hours, assumed a slight red tinge; boiling water and spirit of wine, a red of a deeper colour; æther, a slight yellow tinge.

2d. Two drachms of the powdered roots, mixed with eight ounces of water, were distilled in a glass retort, with a gentle heat, when seven ounces of a transparent fluid came over into the receiver, upon which no chemical agent produced any effect. The fire being raised, one ounce more of a fluid tinged yellow came over, which possessed the same properties as the first. The root was changed into charcoal.

3d. A leaden colour was discharged from a piece of cloth by boiling it in a solution of cremor tartar; this cloth was then boiled five minutes in one drachm of the powdered roots of the galium in a gill of water, when it assumed a bright red colour, which was in no manner changed upon being exposed several days to the action of the sun and air. The mild and caustic alkalies diluted with water, heightened this colour; no other agent produced any visible effect. Another piece of cloth, boiled in the same liquor, after the first had extracted most of the colouring particles, assumed a light brick dust colour.

4th. A piece of sarsanet was boiled ten minutes in soap and water, and five in one drachm of the powdered roots of the galium in a gill of water, when

* Page 61. † American Philosophical Transactions, vol. 3.

it assumed a light red colour, upon which chemical agents produced the same effect as upon the cloth.

5th. A skein of cotton thread was soaked in a solution of galls and hung up until dry; upon being boiled in the powdered roots of the galium and water it assumed a slight red colour.

6th. Strips of bleached linen were boiled in the powdered roots of the galium and water, when they assumed a colour of the same tinge as the cotton thread. Pieces of these strips were subjected to the operation of the following agents: solution of the vegetable alkali in water, greatly deepened the colour; mild vol. spt. sal ammoniac, produced the same effect; caustic spirits, sal ammoniac, ditto. Soap washed out this colour, and changed the linen to its original tinge. Neither vinegar, nor vitriolic, nitrous or marine acids diluted with water, nor solutions of manganese or zinc in the vitriolic, nitrous or marine acids, nor mercury in the vitriolic or nitrous acid, nor tin in aqua regia, nor solutions of corrosive sublimate, saccharum saturni, muriated barytes, arsenic, tartar emetic, or allum produced any effect upon it.

7th. The linen was animalized by soaking it in putrid blood, and then boiled in the powdered roots of the galium and water, when it assumed a dirty brown colour. As it has been supposed by some, that the Indians conceal the method of fixing the colour of the galium, and by others, that it is set by the juice of crab-apples, or the berries of the sumach, a common clarified goose quill was boiled in the powdered roots and water, when a red colour was imparted to it, equal in brilliancy to the colour of any of the porcupine quills dyed by the aborigines of our country.

Thus, Sir, I have given you a chemical history of the galium tinctorum; though the experiments are few in number, yet I conceive them to be complete; we see the dye on cloth and silk is durable; neither

ſun, air nor moiſture, nor any chemical agents, the alkalies excepted, change its colour. It promiſes to become a valuable article in the art of dying, and credit is certainly due to the agricultural ſociety of New-York, for their exertions in obtaining a true account of its uſe in this important branch of manufactures.

An account of new conſtructed Fire-Places; by JOHN STEVENS, *Eſq. in a Letter to Robert R. Livingſton, Preſident of the Society.*

I LATELY borrowed from our worthy ſecretary, Dr. Samuel L. Mitchell, an ingenious work recently publiſhed by Count Rumford, the ſame gentleman who, under the name of Sir Benjamin Thompſon, has ſo eminently diſtinguiſhed himſelf by his ſpeculations on heat, &c. Among other intereſting ſubjects diſcuſſed by the Count in this book is, "An Eſſay on Chimney Fire-Places." After detailing at conſiderable length his improvements in the conſtruction of chimney fire-places, in order to prevent ſmoaking and to throw out into the room more heat, he in a note has the following paſſage:

"I have of late been much engaged in theſe inveſtigations, and am now actually employed daily in making a variety of experiments with grates and fire-places upon different conſtructions in the room I inhabit, in the Royal Hotel in Pall Mall; and Mr. Hopkins, iron-monger to his Majeſty, and Mrs. Hempel, at her pottery at Chelſea, are both at work in their different lines of buſineſs, under my direction, in the conſtruction of fire-places upon a principle entirely new, and which, I flatter myſelf, will be found to be not only elegant and convenient, but very economical. But as I mean ſoon to publiſh a particular account of theſe fire-places, with drawings and

ample directions for conſtructing them, I ſhall not enlarge farther on the ſubject in this place."

Thus far the Count—I feel impatient to hear the reſult of his various experiments.

It has long been a favorite object of ſtudy with me to invent ſome eaſy mode of preventing the immenſe waſte of heat which is evolved during the combuſtion of fuel in fire-places of the ordinary conſtruction. Probably not leſs than two thirds of this heat, inſtead of being applied to the purpoſe of warming the air of the room, is ſuffered to make its eſcape and to be ſwallowed up by the wide extended throat of the chimney. The peruſal of the paſſage above quoted, where the Count announces to us "that he is actually engaged in the conſtruction of fire-places upon a principle entirely new, and which, he flatters himſelf, will be found to be not only elegant and convenient, but very economical." The peruſal of this paſſage, I ſay, has operated as a powerful ſtimulus with me to loſe no time in reducing to practice, by actual experiment, my ideas on this important ſubject. Whether the modes we have purſued to effect one common purpoſe bear any ſimilarity to each other, time will diſcover; in the mean time we can form no probable conjecture from the general terms in which he ſpeaks of his improvements.

That I might not be *wholly* anticipated by this ingenious chimney-doctor, to work I went immediately, on the fire-place to my office, which was very liable to ſmoke, owing to the chimney being overtoped by the roof of Chancellor Livingſton's houſe. As the fabric I have conſtructed was not completed till yeſterday, I have not yet had a full trial of its effect. A fire has been kept up in it during the afternoon of yeſterday, and the greater part of this day; and though the maſon work is ſo green it has carried ſmoke perfectly well, and I flatter myſelf the improvement with reſpect to the ſaving of fuel, will be very great. For further ſatisfaction I beg

leave to refer to Dr. Mitchell, who was preſent at the firſt trial I made.

Had I not been ſtraightened for time, I ſhould have had the back and about two-third parts of the ſides caſt in one piece of iron, notwithſtanding that Count Rumford reprobates iron as an improper material in the conſtruction of fire-places. But for the very reaſon (independent of others) he condemns it, I am convinced that in fire-places conſtructed as above deſcribed, caſt iron is perhaps the moſt eligible material. Its being a powerful conductor of heat is ſo far from being an objectional property, that it really is a capital advantage, when matters are ſo contrived, that the heat abſorbed by the iron, inſtead of being loſt in the wall behind the back, is conveyed into the general maſs of air in the room. The greateſt objection to the uſe of metallic ſubſtances about a fire-place, is a diſpoſition of acquiring and retaining a higher temperature of heat than any other bodies, commonly uſed for this purpoſe. Iron ſtoves for inſtance, are liable to become ſo heated as to roaſt or fry ſuch oliagenous particles as are depoſited upon them, by which a complication of bad ſmells are ſet looſe: this circumſtance renders theſe ſtoves very offenſive to delicate conſtitutions; but in the conſtruction of the fire-places recommended in this memoir, the objection here ſtated is completely obviated.

I will now proceed, with the indulgence of the ſociety, to a deſcription of the fire-place I have conſtructed.

Figure 1 is the ground plot; the line *a b* is the outſide face of the brick work which cloſes up the aperture of the former fire-place; *c* is the back of the preſent fire-place, which is a plate of caſt iron placed at two inches from the wall at the bottom; openings are left in the jams at *d* and *e*, by which the hollow ſpace between the back plate and the wall communicates with the air of the room. It is unne-

ceſſary to give the dimenſions of the different parts, as they are expreſſed in the figure.

Figure 2 is a front view of the elevation of figure 1, *a* is the aperture of the fire-place, *b* the breaſt-work of brick, *c* the jams, and *d* a dome of ſheet iron. The dimenſions of the parts are expreſſed in the figure.

Figure 3 is a ſectional ſide view of figure 2, *a* the aperture of the fire-place, *b* the throat of the chimney, *c* a plate of ſheet-iron making a diviſion of the dome to within a foot of the top, by which means the ſmoke is made to aſcend within the front ſection of the dome to the top, and to deſcend again in the back part to the aperture *f*, and thence up the chimney. This aperture *f*, whenever the fire is burnt down, may be cloſed, by which means the heat in the fire-place will be prevented from paſſing up the chimney, and the temperature of the air in the room will thereby be continued warm a long time: *e* is a plate of ſheet iron regulated by the ſcrew *d*.*

Fire-places of the dimenſions above deſcribed, will be ſufficiently large for rooms of a moderate ſize, and for rooms of a larger ſize the fire place ought not to exceed 18 or 20 inches wide in the back, and 14 inches deep.

The materials of which fire-places on this plan may be conſtructed, can be varied, ſo as to accommodate every ſituation. Where elegance is not required, freeſtone, brick, tile, caſt or ſheet iron may be uſed; but where ornament is ſtudied, the baſe may be of marble, and the dome either of marble or of ſheet-copper, japaned or guilded. The form too of a fabric ſuch as I have deſcribed, may be diverſified in a thouſand ways, ſo as to afford ample ſcope

* This I have found to be of great advantage, as in cold weather the throat of the chimney will bear to be contracted without danger of ſmoaking. This leſſens the currant of cold air which is conſtantly ruſhing in from every crack or crevice.

to the diſplay of taſte and fancy. The baſe indeed is not ſo ſuſceptible of variety in its form, as is the ſuperſtructure. which is capable of being moulded into an infinite variety of elegant ſhapes, ſuch as columns, obeliſks, pyramids, and figures of a conical and eliptical form.

The above memoir was prepared to lay before the ſociety at their meeting on Tueſday laſt, but as few members met, and a board was not formed, it was not then read. Since that time I have kept a conſtant fire in my new conſtructed fire-place, and it is with great pleaſure I now inform the board that its effect in warming the room, and the conſequent ſaving of fuel is even beyond my moſt ſanguine expectations. *January* 21, 1797.

APPENDIX.

Obſervations on the Means of Improving the Manufacture of Flour, and Diminiſhing the Conſumption of Water in Grinding.

By ROBERT R. LIVINGSTON, *Eſq. of Clermont.*

POSSESSING ſome flouring mills, I was naturally led to converſe at times with my millers on the means by which flour was rendered better or worſe, and on the economy of water in grinding. They gave me facts, which I found confirmed by other millers, from whom, as occaſion offered, I made enquiry on theſe ſubjects. One ſeemed to be generally admitted and confirmed by my own obſervations, to wit, that no two mills, apparently in ſimilar circumſtances, made flour of the ſame quality with the ſame quantity of water. Though geered alike, one mill would make worſe flour, or require more water than the other. Another fact was admitted: That if the mill moved too ſlow, or fed too faſt, the

flour was generally bad, being then ground flat, or dead, in the miller's phraſe. It would pack together, and not riſe when levened, ſo well as that which was ground lighter, or as they call it, ſharper.

This laſt fact explains the firſt, and ſhews that the flour was injured by the too great preſſure of the mill ſtone, which muſt neceſſarily happen when the centrifugal force is diminiſhed by the ſlow motion of the runner (or upper mill ſtone) or when an undue proportion of grain is at one time admitted.

Though no miller that I have converſed with, could explain the phenomenon I have before mentioned, yet it is obvious from this laſt fact, that one mill grinds with leſs water, and makes better flour than another, in apparently ſimilar circumſtances, becauſe one grinds more by *attrition*, the other by *preſſure*. The laſt will require more water, becauſe the friction is of courſe greater, in proportion to the weight with which it lays upon the grain, and the flour bad in the ſame ratio. Some weight, however, is neceſſary to break the grain with facility; what this weight ſhould be, has never yet been aſcertained, nor can it be upon mills of the preſent conſtruction with any degree of accuracy. To enable millers to do this was the object of my enquiry. The reaſon why one of two mills in apparently ſimilar circumſtances makes better flour than the other, with leſs water, will be found in the different degrees of elaſticity in the bridge tree, (that is the beam that carries the mill ſtone.) If a ſupport is placed under the centre of this beam, directly below the point of the ſpindle, ſo as to prevent it from ſpringing, the flour ground while it remains there is ground dead, and the ſtones evidently choak and labor more, becauſe they cannot relieve themſelves, or riſe when clogged by the grain, without raiſing the mill ſtone; whereas when the bridge tree is elaſtic, it will of courſe be ſomewhat bent by the weight of the ſtone, and muſt therefore aid the ſtone by its effort to riſe.

But as it was impoſſible to determine with accuracy the neceſſary ſpring, which, if great, would endanger the breaking of the bridge tree, or be ſubject to vibrations, which would ſuffer the wheat to paſs before it was fully ground; or if too ſmall, it would be ſubject to the defects I have mentioned. It has never, I believe, been an object of conſideration with mill wrights, but left to hazard, and hence the difference I have noticed in mills of a ſimilar conſtruction. The firſt idea that ſtruck me, was to place the pot in which the ſpindle runs, in a box of wood or caſt iron, and to annex to the ſpindle a block of light wood that ſhould fill the box within 1-8 of an inch all round. If quickſilver was put into the box, ſo as to fill the intermediate ſpace, the wood would then operate as if it diſplaced a quantity of mercury proportioned to its ſize, we will call its ſolid contents one cubic foot. It would be beſt, however, to make its height, compared with its breadth, as great as poſſible, in order to diminiſh its motion and friction. A cubic foot of quickſilver weighs 947 lb. ſuppoſing the block of wood to weigh 47 lb. the mill ſtone would be buoyed up 900 lb. As this is the ordinary weight of a mill ſtone, it would in this caſe have no preſſure upon the grain, while its momentum would remain as it was when put in motion. This is an important conſideration, ſince the facility with which corn is broke by mere attrition, muſt depend upon the momentum of the ſtone. If a mill could be ſo conſtructed as to have the momentum of the heavieſt ſtone, and the friction of the lighteſt, it would require but little more water to turn a ſtone of 1200 lb. than it would to turn one of half that weight, and when once in motion, it would require leſs water to continue it, if the ſame obſtacle was oppoſed to the motion of both. In this mode too, the friction upon the point of the ſpindle would be greatly diminiſhed, and the ſame principle applied to gudgeons might I think be much more advantageous in diminiſhing

friction, than friction wheels, without their wear and nicety. The drawing annexed will explain my meaning very fully. It muſt not, however, be underſtood, that a mill can break corn without ſome preſſure. The eaſe with which the ſtones would be raiſed in this caſe, would render the flour coarſe, and even permit the ſmaller grains to eſcape unbroken; but it is certain, that hand mills, where the ſtone does not weigh more than 200 lb. will not only break corn, but it is generally ſuppoſed in France, where they are much uſed, that they flour better than the heavy ſtones uſed in water mills; by the means I have deſcribed, a ſtone of 2000 weight may be made to preſs no more than one of 200, while its power in breaking by mere attrition, would be proportioned to its weight. This mode, however, from the difficulty of procuring mercury in the country, I did not reduce to practice, though I ſhould certainly prefer it to the one I am going to mention, by which I effected the ſame object, though perhaps leſs advantageouſly. I joined two oak plank 2 1-2 inches thick and four feet long, by a ſtrip of ſtrong harneſs leather ſoaked in oil, ſo as to be water proof, in the manner of a bellows, ſo that the plank could riſe or fall 3-4 of an inch. This was fixed by two clamps at each end upon the bridge-tree of one of my mills; at one end I inſerted a tin tube, one inch diameter, and four feet long. To the bottom of the bellows (as I called it) I annexed a plug, by which I could diſcharge the water without ſtopping the mill, when I wiſhed to make an experiment. A few ſmall tacks driven into the lower planks on the inſide, kept, by their heads, the planks from cloſing ſo as to prevent the admiſſion of the water. On the centre of the upper plank, I placed the pot, in which the ſpindle turns. It is obvious that when no water was put into the tube, this mill differed in no eſſential point from one upon the common conſtruction; but that, when water was poured into the tube, the preſ-

ſure of the bellows upward, and of courſe of the mill ſtone, would be proportioned to the height of the water in the tube, and the ſurface it acted upon in the bellows. This ſurface being four feet, one foot of water in the tube would operate to diminiſh the preſſure of the upper ſtone 250 lb. If the tube was filled with water, the mill ſtone would be raiſed the whole height to which the bellows could riſe, unleſs it weighed more than 1020 lb.

Having fixed the apparatus, I came on a day appointed for the trial, with ſeveral of my friends, and an experienced miller. I found the miller grinding new and damp wheat in that mill, which choaked, and paſſed through with great difficulty; when I poured from a tea kettle into the tube, as much water as diminiſhed the preſſure of the mill ſtone about 500 wt. he ſaw, to his great aſtoniſhment, that without any additional water on the wheel, the mill had quickened its motion, and that the flour paſſed readily without choaking.

I then graduated the flood gate of the mill race, giving it juſt ſo much water as the miller determined was neceſſary to make good flour, and emptying the bellows of water, I directed the miller to convert two buſhels of wheat into the beſt flour he could make, marking the time he took to do it by my watch. When he had finiſhed, (leaving the gate as it ſtood) he put in two buſhels of wheat from the ſame parcel, and gave over the management of the mill to me. I having undertaken to make better flour, in leſs time. I conjectured that the mill ſtone weighed about 900 lb. and accordingly inſerted 2 1-2 feet of water in the tube, which diminiſhed the preſſure of the ſtone upon the grain 625, leaving only 275 lb. (calculating as if the ſtones were at reſt) though the diminution muſt have been much greater if the centrifugal force is taken into conſideration. In this way I finiſhed my taſk in one fourth leſs time than the miller took to perform his, and the flour (though the

firſt I ever made) was ſenſibly better than his. Indeed it will hardly be poſſible for the moſt ignorant miller to make bad flour, if the ſtones are large and heavy, when the preſſure is taken off in the way I propoſe, unleſs it be by feeding much too faſt, which may perhaps make it coarſe; but it can neither heat, or be ground dead, the common cauſes of bad flour. From this experiment two important conſequences reſult: Firſt, the improvement of the flour. Second, the ſaving of water. I ſhould, however, have ground to more advantage, had I left ſomewhat more weight on the grain, ſince I found that care was neceſſary in my experiment to prevent the mill from feeding too faſt, the velocity of the mill ſtone being near 1-3 more than in ordinary grinding with the ſame water. When the mill received too much wheat, the centrifugal force, and the extremely light preſſure would, if too much wheat was admitted at once, permit it to paſs before it was ſufficiently ground. Other occupations, and the diſtance of my mill from my houſe, prevented my purſuing theſe experiments, ſo as to aſcertain accurately the due quantity of preſſure to ſave water, and make the beſt flour. The greater the weight, and the larger the diameter of the mill ſtones, the leſs the preſſure on the grain need be, becauſe their power of attrition would be proportioned to theſe. Enough, however, was done, to ſhew that both may be effected by theſe means, and I have no doubt, that if the upper mill ſtone was to weigh three or four thouſand pounds, and the preſſure to be reduced by either of the means I have mentioned to about 300 lb. that the flour would be greatly improved, becauſe little inequalities in the feeding of the mill would have no effect in obſtructing the motion of a body moving with ſuch momentum. For the ſame reaſon a very conſiderable ſaving of water might be made by uſing a large and heavy mill ſtone, becauſe the friction would not be encreaſed except on the point of the ſpindle,

while the obſtruction to the ſtone's motion, by the grain in attrition remaining the ſame, it muſt always be relatively leſs in proportion to the momentum of the ſtone, after it had once been ſet in motion. The drawings will fully explain the means I propoſe for this purpoſe, and the extreme ſimplicity of them enables any miller to try their effect at a trivial expence.

ROBERT R. LIVINGSTON.

On the Methods of introducing Heat into Rooms, and preventing its eſcape; in a Letter from SIMEON DE WITT, *to Samuel L. Mitchell, M. D.*

I HAVE always conſidered ſtudies having for their object the means of leſſening the labor or expence neceſſary to procure the comforts of life, among the moſt uſeful in which man can be engaged. Every diſcovery, made in ſuch purſuits, is valuable, even if the occaſion to which it may be applied be temporary and tranſient in its nature. But if its advantages are of ſuch a kind as, that a great part of the bulk of mankind can be benefited by them, not only for the preſent, but for ages to come, its value will puzzle the powers of calculation. In this light I conſider every improvement in the economy of warming rooms, in order to make them comfortable habitations in cold weather, a ſubject which has been left conſiderably in the dark; it ſhall therefore occupy the contents of this letter, and with thus much of an introduction, I ſhall enter on it without further ceremony.

A given quantity of fuel, when burnt, will give a certain quantity of heat. Means may be uſed to increaſe the intenſeneſs of it, but it is not pretended that the *quantum* can be augmented. The thing under conſideration then is, only, how ſuch a given quantity of heat can be applied to the uſe intended

with the leaſt waſte. The uſe intended is, to warm the air of a room, and to preſerve the warmth as long as poſſible, conſiſtent with health and comfort. This divides my inquiry into two branches, which I ſhall conſider ſeparately, and begin firſt with *the means of preſerving heat in a room.*

1ſt. From the properties of airs of different temperatures it follows, that where currents of theſe meet, that which is coldeſt will paſs on below, while that which is warmeſt will make its way in an oppoſite direction above it. In this manner the air next to the fire-place being warmed, will aſcend to the cieling and move along it to the walls, where it will be drawn into the currents that enter by the crevices of the doors and windows, and return with them to ſupply the draught of the chimney; for the air that goes up the chimney muſt be ſupplied by an equal quantity coming into the room by ſome opening or another; and if a room be perfectly tight, it is impoſſible that the chimney can draw at all. The air warmed by the fire, in the paſſage which it immediately takes, as juſt mentioned, parts with the greateſt proportion of its heat to the ceiling and walls along which it moves, as well as to the entering air with which it mixes before it can benefit us on its return in the lower parts of the room; and thus, the greater part of the heat received into the room, is abſolutely loſt to us. How is this to be remedied, becomes, therefore, a primary queſtion in our inveſtigation? If we could point out a method to make the ceiling, walls and floor of materials that would be perfect non-conductors of heat, and at the ſame time could prevent freſh air from entering, it is evident the queſtion would be completely anſwered; that is to ſay, ſuch a room once warmed, would remain warm for ever: But no ſuch materials are to be had, and freſh air muſt be admitted both for the purpoſes of breathing and ſupplying the draught of the chimney. All

we can do, therefore, is to endeavor to come as near to this ſcheme as the nature of things will admit.

From the circumſtances ſtated, it appears obvious that very much will depend on the materials incloſing a room. Whether they are ſubſtances that will readily or difficultly abſorb or carry away heat, will make a vaſt difference in the qualities of a room. An inquiry into theſe properties, as reſiding in different ſubſtances that may be uſed, therefore becomes neceſſary.

If we take two wires, one of glaſs and the other of metal, and hold them between the fingers, at no great diſtance from the ends, applied at the ſame time to the blaze of a candle, the one made of metal will ſoon communicate an intolerable heat, while the other will produce no ſuch effect. From this familiar experiment, it is then apparent that metal is a ſtronger conductor of heat than glaſs, or that heat will be carried away more rapidly and in greater quantities from a body that is charged with it, to any other leſs charged, when metal makes the communication, than when glaſs is interpoſed.

If the hand be applied to furs, or ſoft woolen ſtuffs, expoſed to the coldeſt weather, no ſenſation of cold excepting for the firſt moment is ſuffered, whereas when applied to metals, ſtones and many other ſubſtances that have in the ſame manner been expoſed, the cold will be unſufferable and permanent. The philoſophy of theſe phenomena is this: *when heat, by any cauſe, is more rapidly taken from any part of the human body, than is generated by the animal functions, the ſenſation of cold is produced; and if any thing prevents its eſcape as faſt as it is thus generated, a ſenſation of heat is the conſequence.* It follows then, that furs and woolens are ſuch imperfect conductors of heat, that when a limb is wrapt up in them, they refuſe to carry off the heat ſufficiently faſt to prevent its accumulation, which is ſometimes to ſuch a degree that nature is obliged

to call to her aid an extraordinary ſupply of moiſture from the body to diſſipate it.

Theſe inſtances will ſhew what is meant by conductors and non-conductors of heat, and how it may be known what the properties of different ſubſtances are in ſuch reſpects. It is moreover ſaid, that non-conductors of electricity are generally imperfect conductors of heat, ſuch among others is dry air: and this explains why things of a looſe, porous texture are found warmer (to uſe the common expreſſion) than thoſe of a more compact make, as is the caſe with feather beds, quilts, blankets, baizes, carpetings, &c. In addition to the non-conducting qualities of the materials of which they are made, it is greatly owing to the ſtagnant air contained in the vacuities of their compoſition, that the paſſage and eſcape of heat is obſtructed and prevented. From this, by the by, may be underſtood the neceſſity of airing beds and bed cloaths every day, in order to expel the great quantities of moiſture they imbibe from uſe in the courſe of the night, if we expect all the warming effects they are intended to produce. A practice, too much neglected, at the expence of health and comfort.

The foregoing hints will aſſiſt the architect in the choice of his materials for conſtructing houſes beſt fortified againſt the winters cold. Walls made of ſeaſoned timber, if my theory is right, will always be better than thoſe made of brick or ſtone; and if they are made hollow, they will be ſtill the better. In this view, I admired a houſe built by our old friend, Judge Zephaniah Platt, at Plattſburgh, which I lately had an opportunity of ſeeing. It is a frame building, incloſed with thick boards, all the edges of which are grooved with a carpenters plow; they are joined together by ſinking the inner edges of the upper boards into the grooves of the lower ones, while the outer edges of the lower boards go into the grooves of the upper ones. This, while it makes

the incloſure perfectly tight, adds handſomeneſs to the appearance. The inner part of the wall is made of brick, maſoned up between the poſts, ſo as to leave ſome inches between it and the outer incloſure. By theſe means, the whole houſe is with little interruption, ſurrounded by a hollow wall, containing a body of air, cloſely confined and ſecured againſt the moiſture of the atmoſphere, to guard againſt an eſcape ef heat from the rooms. The hollow which is commonly left between plaiſtered ceilings and the upper floors to which they are attached, helps, in the ſame manner conſiderably to preſerve the warmth of rooms: but it is to be obſerved that the coats of plaiſtered walls and ceillings are generally made as ſmooth as poſſible, and poliſhed ſurfaces allowing circulating airs to come in contact with them in more numerous points than others would do; they will of courſe have the power of depriving ærial fluids of their heat with greater facility, not only on account of their ſmoothneſs, but alſo on account of the denſity of texture they have acquired by the operation of giving them that finiſh, and from which they have received almoſt the properties of ſolid ſtone.

Upon the whole, I know no better way to ſecure the warmth of a room, than clothing the walls and ceiling with tapeſtry or ſomething poſſeſſing ſimilar properties. This would be the moſt effectual guard againſt cold in addition to the precautions commonly uſed; and might be practiced with a degree of elegance; or, if you pleaſe, with a magnificence ſuperior to what any mode now cuſtomary affords: at the ſame time, by only varying the materials, the ſame end might be attained conſiſtent with the ſtricteſt economy. For inſtance, green baize, which is a cheap article, if handſomely ſpread along a rough caſt ceiling, would by no means, make an inelegant ſhew; nor would it have an unpleaſant effect, if a room was entirely hung round with it. Furs as uſed

by the inhabitants of the Frigid Zone, would anſwer this purpoſe in a much more perfect and admirable manner. We, however, would have ſerious objections to the expenſiveneſs, if not to the ſavage appearance of ſuch a dreſs, for our habitations.

I forbear to enumerate materials that might be employed for the purpoſes in view, ſince the principles laid down, will ſufficiently direct to a proper ſelection of them.

2d. I ſhall now in the ſecond place, beſtow ſome reflections on *the means of communicating heat to rooms*. Theſe are of various kinds; but before we take a view of them, in order to aſcertain which are beſt, it will be proper to conſider how fire and the heat produced by it, act.

While fuel is burning, the heat generated, is conveyed to diſtant bodies, in two ways. One is in ſtraight lines or rays, carried in every direction from the fire, with the light which it emits; the other is with the ſmoke or vapor, that riſes from it. The beſt contrivance to catch the heat in its flight either way, is what we are in ſearch of at preſent.

Of the heat which is ſent forth in direct rays from a fire; the proportion received into the room, compared with the whole, may be calculated from pretty accurate data. Suppoſe in a common fire-place, the centre of the fire to be the centre of a ſphere of any given ſize, and an infinite number of rays or radii drawn from the centre of this ſphere to its ſurface, ſo as to touch the floor jambs and bottom of the mantlepiece; the ſpace comprehended by the lines connecting the interſections of theſe radii on the ſurface of the ſphere, compared with the remainder of its ſurface, will give the proportion of the heat that is thrown directly into the room, compared with that which falls on the hearth, chimney, jambs and back of the fire-place, and which cannot enter the room but by reflection, or ſome other circuitous route.*

* This calculation is made on the ſuppoſition that there is

From the common fire-place, little heat is obtained beſides what comes in this direct manner. It, therefore, muſt be obvious, governing our calculations in this manner, how much depends on the depth or ſhallowneſs of the jambs, and how much may be gained by giving the wideſt poſſible opening or range for the fire to ſpread its rays through a room.

It is on this principle that Count Rumford's celebrated fire-place is conſtructed, and from which it receives its chief advantages. It is true, he recommends whitening the back and jambs, with a view to gain by reflection the benefit of the heat alſo, that may be intercepted by them; but this, in my opinion, can be but trifling. Highly poliſhed ſurfaces only can, in a material degree, ſerve us in this reſpect; and theſe, it would be very difficult, if not impoſſible, to preſerve, in ſuch a condition.

But it is a matter vaſtly more important, to arreſt and ſecure the heat which attempts to make its eſcape with the ſmoke or vapor riſing from the fire, as well as that which is abſorbed by adjoining bodies, and uſually ſteals away to the external parts of the houſe. The quantity of heat thus loſt will appear, by calculations made as aforeſaid, to be much greater than that which is thrown directly into the room.

The contrivances in common uſe, intended to effect this purpoſe, are chiefly the cloſe ſtove and the Franklin. The advantages of the *cloſe ſtove* are theſe: Its draught is ſmall, and requires of courſe but a ſmall quantity of cold air to be admitted into the room to ſupply it. The fire comes largely in

no immediate obſtruction to the emiſſion of heat from the fire. But when we take into account all the obſtructions to the eſcape of heat, excepting by a perpendicular aſcent, cauſed by the different parcels of fuel, and even by coals, though in a ſtate of ignition themſelves: It muſt be obvious that large deductions muſt after all be made from the reſult of calculations on the principles ſtated; and thus the proportion of heat ordinarily ſaved will become reduced, by undeniable proofs, to a much ſmaller amount than is generally ſuſpected.

contact with its ſides, which being made of iron, readily conduct the heat into the room, and little of it is carried away by the draught. Its diſadvantages are, the large ſpace which it occupies, its inelegancy, and the diſagreeableneſs and unwholeſomeneſs of the air which it heats. It is, however, the cheapeſt method of warming a room, though it can claim even in this reſpect, but a trifling preference to the Pipe-Franklin.

The Franklin is either maſoned to a chimney, or placed independent of a wall with a pipe to carry off the ſmoke. The latter kind differs little from the cloſe ſtove, as juſt obſerved, in its qualities for warming a room. It requires, however, more air for its draught; but at the ſame time it gives a direct heat in the manner of a common fire-place. The Franklin maſoned to a chimney, differs from the common fire place in this reſpect: beſides the properties common to both, it ſends up a current of heated air from its ſides and top, which eſcapes the draught of the chimney, till it has made the circuit of the room.

Beſides theſe, ſeveral other contrivances have been made, which it is not neceſſary to my deſign, to make ſubjects of critical remarks. I think it proper, however, to obſerve, that the one lately communicated to the ſociety, by Mr. Stevens, is well worth attention. As it is in the nature of an appendix to the common fire place, the heat gained by it is a clear ſaving.

I ſhall now, by way of concluſion, give two projects of my own. The one is the moſt perfect I can think of for introducing the heat of a fire into a room; the other I would call the ſimpleſt and moſt convenient. Both being conſtructed with an eye to the preſervation of a due degree of freſhneſs and wholeſome reſpirability in the air.

The one to bring as much as poſſible of the heat of a fire into a room, would be this: let a Pipe-Franklin be placed in a common fire-place, whoſe

chimney ſhould be of ſuch a width as that the pipe might run through it without touching its ſides. Let the pipe be thus carried through it beyond the top. Let the top of the chimney be then cloſed round the pipe air tight. Let a tin tube of about two inches diameter be carried from the lower part of the building on its outſide to the top of the chimney, and there communicate with it; and laſtly, let an opening be made from the chimney into the room, a little below the ceiling. Perhaps it would be of ſervice to have the inſide of the chimney white waſhed. The operation of this conſtruction would be thus: the heat that would not be directly emitted into the room, would aſcend with the ſmoke into the pipe, which would readily abſorb and tranſmit it to the ſpace in the chimney ſurrounding the pipe; and the current of air conſtantly preſſing into the top of the chimney through the tin tube, would force this heated air down into the room through the opening near the ceiling, ſo that all the heat communicated to the pipe from its bottom to its top, would, with little exception, be carried back into the room; and this, in a high chimney, would be nearly all that is carried away by the ſmoke. The draught, moreover, would thus be ſupplied with warm inſtead of cold air. It is eaſy to be perceived that the ſame contrivance may be applied to a common fire place, by only cloſing the chimney round the pipe at the bottom as well as the top.

My other project is this: maſon a caſt iron plate for the back of the fire-place faſt, in the uſual poſition, ſome inches from the back of the chimney. To its top, let a ſheet of plated iron be joined, and carried perpendicularly up as high as the ceiling of the room, with its edges maſoned in the ſides of the chimney, and its top bent backwards and faſtened into the back of the chimney. From the hollow ſpace between this iron petition and the back of the chimney, make ſmall openings into the

room, one on each ſide through the jambs near the floor, and one on each ſide near the ceiling. The operation of this contrivance then would be thus: the heat that would otherwiſe eſcape with the ſmoke will, in a great meaſure, be communicated to the iron partition, and thence to the air behind it, which would immediately aſcend and paſs into the room through the upper openings, while the colder air would preſs into thoſe near the floor, thus making a quick circulation through the cavity between the iron plates and the back wall. By thoſe means, the heat of the chimney would be drawn into the room with great rapidity; for the quicker the ſucceſſion of freſh air or any other vehicle coming in contact with a heated body, the greater will be the quantity of heat conducted from it in a given time.

The ſimplicity, cheapneſs, efficaciouſneſs and conveniences of theſe contrivances, unleſs my reaſoning about them is more fallacious than I ſuſpect it to be, muſt recommend them. They take away no room. They do not affect appearances. They require no art in the conſtruction. Their expence will be trifling. In ſhort, they poſſeſs all the good properties of the Franklin, but in a more perfect manner and in higher degrees, without its chief inconveniences, and the firſt opportunity I have, I intend to make an effectual trial of them. In the mean while, if any of your acquaintances ſhould be inclined to pay attention to ſuch theories, or make experiments of my projects, you are welcome to communicate them in ſuch manner as you may think proper. If I have, in any reſpect, erred in my ideas of the phyſical properties of the elements, whoſe agency it has been neceſſary to conſider, I ſhall expect your friendly corrections, as from one who has penetrated deeper into the receſſes of nature and ſcrutinized her myſterious works more thoroughly than any other to whoſe criticiſms I can ſubmit my own conceptions of things.

Obſervations on the Manner in which Bot-Worms are generated in Horſes, and the Means of Prevention; in a Letter from Chancellor LIVINGSTON, *to Doctor B. De Witt, and from Major* ANDREW BILLINGS, *of Poughkeepſie, to Mr. Livingſton.*

CLERMONT, 28*th November*, 1799.

DEAR SIR,

I OMITTED the encloſed drawing in my laſt. I now tranſmit a letter from Major Billings, on the ſubject of thoſe troubleſome inſects, the bots. It points out an eaſy method of guarding againſt them; and as the flies are by no means numerous or difficult to kill, if every man would be attentive to deſtroy thoſe he found buzzing about his horſe, as well as to remove the eggs, as Mr. Bilings recommends, I think they might be in a great meaſure extirpated. The flies may be known from any other, not only by the deſcription contained in the encloſed letter, but from their peculiar mode of flying when they endeavor to depoſit their eggs, which they always do while they are on the wing. They then fly with their heads and bodies erect, and perpendicular to the horizon, while their tails form a ſharp angle with their bodies, being bent towards the horſe, ſo that they touch the hair of his legs or belly (which are the parts they moſt affect) only with the extremity of the tail; and in this way will fly about him for an hour, diſcharging a great number of eggs, which adhere to the ends of the hair. How the worm afterwards makes its way into the inteſtines of the horſe, I know not, but I think it out of doubt, from Major Billings's obſervation, that the egg on the horſes hair produces the bot-worm; and that the fly he ſpeaks off depoſits the egg, may be inferred from his obſervations; but this point is put out of doubt, by an experiment which the late Doctor Vrooman Wemple (a man whoſe veracity

or accuracy cannot be ſuſpected) made. A horſe of his having been killed by the bots, he took the largeſt of the worms, and preſerving them in a proper temperature, they went through the uſual changes and produced flies exactly reſembling thoſe already deſcribed. It muſt follow from theſe diſcoveries, either that our bot differs from that of Europe, or that Valiſnery is miſtaken in his hiſtory of it, when he aſſerts that the eggs are placed by the fly in the anus of the horſe; but as the horſes of this country have all been originally imported, I preſume that the bot was brought over with them, becauſe they are, I believe, only to be found in animals of that ſpecies; nor is the detection of this error unimportant, ſince were Valiſnery's ideas on this ſubject correct, the evil could not be guarded againſt; whereas Major Billings has pointed out a remedy which is within every man's reach.

I am, &c.

ROBERT R. LIVINGSTON.

Dr. De Witt.

Sir,

THE great benefits which this country has received from your diſcoveries, and your conſtant endeavors to promote uſeful knowledge, has induced me to tranſmit to you ſome obſervations I have made on the origin of that ſpecies of worm called bot. If the information I poſſeſs of its mode of generation and the way in which it is productive of ſo much miſchief, lead men of talents and literature to extend my reſearch on this ſubject, I ſhall feel myſelf happy in the idea of being once in my life ſerviceable to mankind.

Some time in the ſpring of 1798, I loſt a valuable horſe, which on examination I found to have died

of bots: hence I was led to ſome enquiries about them of people who were acquainted with horſes, and from whom I hoped to obtain information. No one gave me the leaſt ſatisfaction relative to the manner in which they were bred; nor could any one inform me whence they proceeded.

I betook myſelf on this account to authors, where I met with various and lengthy deſcriptions; they appeared to me obſcure and indeciſive.

During the ſucceeding ſummer, my horſes were at graſs two or three miles from town; and when brought home (I believe in the month of Auguſt) I obſerved three flies about them of the ſize of a honey-bee, and on their head and neck not much unlike it. I examined them and perceived that they bore ſome reſemblance to the bot-worm, particularly about the head. This circumſtance ſuggeſted to me the idea of viewing the nits which were attached to the hairs of the horſes (the nits exiſted in large numbers, and principally on the horſes legs and ſhoulders) through a very good double reflecting microſcope; but I ſaw nothing more than an egg apparently glewed to the hairs to which the nits were fixed; and giving up the proſpect of diſcovery, I threw the forceps which held the hairs into the microſcope, and left it.

Some time after, on opening the box and taking up the forceps, I noticed ſomething moving the hair: I placed the hair under the magnifier No. 4, and remarked, to my ſurpriſe, that it was agitated by a perfect bot. The egg had broken open on one ſide, and the bot was endeavoring to extricate itſelf: Its exertion was ſo ſtrong that it would ſometimes turn the hair quite round.

I was delighted with this diſcovery, inſomuch that I called in ſeveral perſons to enjoy it with me. It was manifeſt to all of them. I put the bot between two glaſſes for the purpoſe of renewing my examination of it, and to give my ſtep-ſon, Doctor Van

Vleeck, an opportunity to inſpect it more minutely; but on taking it from between them two days after I found that it was dead.

I appropriated this diſcovery at once to a domeſtic concern. I ordered my people to take a knife and ſcrape off all the nits that were on my horſes; and I am perſuaded, if farmers and others would take the trouble to keep their horſes freed from theſe nits, that they would never loſe them by bots.

I have only to add, that the hiſtory which I have detailed to you of my obſervations, is a very brief one; and that I have the honor to be, with reſpect, &c. &c.

ANDREW BILLINGS.

Poughkeepſie, November 22, 1799.

A Treatiſe on Silk Worms: In two parts. The Firſt on their Management within Doors, and the Second concerning their Treatment in open Air upon Hedges.

By PETER DE LA BIGARRE, *Eſq.*

[Omitted in Part ii.]

Firſt Query.

WHENCE ſhould you get the eggs commonly called *ſeeds of ſilk worms?* What kind will ſucceed, and are beſt calculated for this country?

Anſ. Many people are of opinion, that preference ought to be given to eggs of a warmer climate than that intended for the raiſing of ſilk worms: but we are inclined to believe that ſuch preference is rather due to thoſe eggs raiſed in a climate of the ſame temperature, as it is obvious, that the change of air and food muſt have a great influence upon the worm, at leaſt for the firſt year. However the moſt important thing is, the choice of the eggs, whether procured from abroad or raiſed at home.

2*d Que.* What is the mark of good eggs, and how are you to diſtinguiſh them from the bad ones?

Anſ. A good egg impregnated by the male, takes ſucceſſively the colour of gridelin, of purple, and at laſt of an aſhy hue: it muſt crack under your nail with a ſlimy and thick matter, whilſt the bad one makes no noiſe when bruiſed, and it is a kind of fluid and *dilated* ſubſtance.

3*d Que.* How are you to preſerve the eggs, and how prevent them from being hatched before the leaves of the mulberry are put forth?

Anſ. You muſt keep the eggs in a dry place, free from froſt in winter, as well as from heat in ſpring and ſummer.

The beſt method is, to leave the eggs on the ſtuff which they were laid upon by the female: you need not take them off ſooner than two or three days before the time of hatching.

4*th Que.* Are the eggs which come out of white cocoons, preferable to thoſe afforded by yellow ones?

Anſ. The eggs of white cocoons, produce worms much inferior to thoſe of yellow cocoons. The reaſon is this:—the white cocoons give leſs ſilk; hence it is very right to preſume, that the worms which made the greateſt quantity of ſilk, were the ſtrongeſt and the moſt free from any diſorder; on the other hand, it has been found by experiment many times, that from 300 to 320 white cocoons give only one pound weight of ſilk, whilſt from 230 to 240 yellow cocoons produce an equal quantity; the ſame difference in the quality, was proved in the ſpinning of both.

5*th Que.* What time is moſt proper to hatch the eggs?

Anſ. As it is impoſſible to determine any particular day, it muſt be calculated from the temperature of each climate and the knowledge of the ſeaſon, relative to the putting forth of mulberry leaves,

in ſuch way as to be certain of getting ſufficient food for the young worms.

Notwithſtanding, the ſooner the better: becauſe the young worms want the tendereſt leaves; thus the moſt proper time to begin the hatching is, when you perceive the firſt buds of mulberry diſpoſed to come out.

6th Que. What is the beſt method of hatching?

Anſ. The choice of the eggs and the method of their hatching, are the two important objects upon which depend chiefly all our future ſucceſs, and in the mean while, it is worth the while to obſerve, that both are entirely at our own diſpoſal. As ſoon as the buds of mulberry are coming out, we muſt take particular care to have our eggs hatched. The eggs muſt be properly divided into ounces, in ſuch a way, that one ounce ſhould be hatched all at once if poſſible, in order to avoid the trouble and labor of feeding ſeparately the worms hatched at different times.

The eggs are commonly put in a ſmall bag, to the quantity of an ounce. If you intend to raiſe a great quantity, at the interval of a day, you put as many bags as you wiſh to hatch at the foot of your bed, under the mattraſs or feather bed, then you move them nearer and nearer by degrees to the middle of the bed. The bags muſt be opened every day, to admit freſh air to the eggs, and facilitate their perſpiration.

When they turn whitiſh, it is a ſign that the worms will come out very ſoon: then a greater attention is neceſſary to the eggs; beſides the cuſtomary airing, they ought to be moved and ſtirred up five or ſix times in the courſe of twelve hours, for fear that the embryo ſhould be choaked by a too cloſe heat. Any inconvenience of that kind, may be better avoided by putting the eggs in ſmall boxes of pine boards, about an inch deep, paſted inſide with white paper, the bottom of which is filled

with cotton of about ſix lines deep and covered with a bit of white linen, upon which the eggs are ſpread.

Though the eggs hatched in that way are not liable to be heated ſo ſoon as in the bags, the boxes notwithſtanding ought to be opened once a day and oftener according to their age or time of hatching.

In Italy, Spain and ſome part of France, it is the buſineſs of women to hatch the eggs of ſilk worms, by wearing the abovementioned bags under their petticoats, and when they go to bed, they put them under their pillow for the night. Each of theſe ways is good, provided care is taken to air them as recommended before. The mean degree of heat moſt ſuitable for hatching, is 42° of Reaumur's, or 96° of Farenheit's thermometer, which is reckoned, the common heat of the human blood.

7th Que. Is it not poſſible to hatch theſe eggs by artificial fire, in ovens, ſtoves, or hot rooms?

Ans. That way is practiſed and recommended by people *raiſing* ſilk worms upon a very extenſive ſcale, but we find that it would require too much expence, to render it practicable to the greater part of our country folks. Theſe coſtly experiments agree very well with ſome curious and rich people, who can afford to build ovens and ſtoves, &c. The moſt eaſy and leaſt expenſive way, ought to fix all our attention at preſent.

Merely to ſatisfy the curioſity of ſome of our readers, we beg leave to give here a ſhort deſcription of a new contrivance for the purpoſe of hatching.

" Under the roof of a houſe, chuſe a room of about ten feet ſquare, and eight or nine feet high; fix a ſtove in the middle, the funnel of which muſt carry the ſmoak out through the roof; make two ſmall openings in the roof, three feet diſtant from the funnel on each ſide; fix on both openings an iron pipe, open around like a grate; it may be made of iron wire ſo as to give an eaſy acceſs to the

air. In the mean while, to prevent the coming in of birds, rats, or any vermin, you muſt cover the top of the pipes with a kind of iron plate made like an elbow, as you might have ſeen many caps fixed on chimneys, turning very much like a weather-cock.

The room being diſpoſed in that way, it remains to build up upon four or ſix poſts, a kind of floor made with boards half an inch diſtant from each other: that floor muſt be about four feet high, and fixed horizontally upon the poſts: on the floor you lay as many ſieves made of clear ſilk ſtuff, or of ſome gauze as you have occaſion and room for; in theſe ſieves you ſpread at the thickneſs of two or three lines only, and as equally as poſſible the eggs to be hatched. Then you muſt regulate the temperature of the room by a thermometer, according to the degree already mentioned. In order to keep an uniform degree of heat, you will have a kind of turning ſocket inſide of the funnel of your ſtove, with which you may open or ſhut up that funnel as you think proper.

The eggs being well ſpread in the ſieves, never run the riſk of being choaked by their natural perſpiration, and there is no need to ſtir or turn them over from time to time, as in the common way of the bags, the heat penetrating as well under as above the ſieves: if you want to give freſh air to the room, you may open the door or a window for a few minutes. This new method of hatching is leſs expenſive than many other contrivances we have ſeen before: provided you can go to the expence of ſuch room, you may hatch as many eggs as you chuſe, without trouble and inconvenience."

8*th Que.* How many days are required for hatching before the worms come out?

Anſ. The hatching will be quicker or ſlower according to the heat or cold to which the eggs have been expoſed in winter, and according to the tem-

perature of the months of February, March and April. But, ſuppoſing the eggs were kept all winter in a proper place, as mentioned before, the worms will come out from nine to twelve days after the beginning of the hatching.*

If this common time of hatching is ſhortened by a haſty fire or ſudden heat, a great number of the worms will periſh in the courſe of the raiſing.

9th Que. After the time above mentioned for the coming out of the worms, how do you know that the remaining eggs will not hatch at all?

Anſ. Whatever care, whatever attention is paid to the eggs, it is almoſt impoſſible that in an ounce of ſeed which contains about 42,000 eggs, there ſhould not be ſome without ſperm or unfit by reaſon of ſome defect; therefore, after two days it is needleſs to wait for other worms, and the remaining eggs muſt be thrown away; they would produce but very indifferent and weak worms.

In conſequence of that ordinary and unavoidable waſte of eggs, we would adviſe to add half an ounce more to every four ounces in the hatching, and ſo on in proportion, to compenſate that loſs.

10th Que. Is it not proper to give ſome previous preparation to the eggs, in order to facilitate their hatching?

Anſ. Experience, the beſt of all maſters, teaches us that they are excluded in a ſtate of the beſt preparation, and that therefore we ought not to meddle or tamper with them. We ſhall obſerve only, that bathing them in wine, or any other liquors, as practiſed by ſome people, is ſo far from accelerating

* Since this article was written, we are informed that the hatching does not exceed 8 or 9 days in this country: this is another proof that this climate is the more friendly and ſuitable to the ſilk worm. Beſides it confirms our other obſervations on the quicker growth in the vegetable, as well in the animal ſpecies of America.

or helping the eggs, that it has a directly oppoſite effect.

11th *Que.* Is it neceſſary to take up the worms the firſt day that they are come out?

Anſ. By all means; becauſe were they to remain longer among unhatched eggs, they would communicate to them a noxious heat, and would contract themſelves ſome diſorder and die before the term of their natural growth.

12th *Que.* Is it neceſſary to feed the worms as ſoon as they come out of the eggs, and how?

Anſ. If the eggs have been hatched in ſmall bags, when on looking into the bag you perceive ſome of the worms coming out, it is time to ſpread all the eggs in a box, the bottom of which muſt be covered with a thin bed of cotton, overſpread with a piece of old white linen; then as ſoon as there is a ſufficient number of young worms come out, you put over them a piece of parchment as wide as the box; that parchment muſt be pierced with holes all over like a ſieve; you lay over it ſome tender leaves of mulberry; you will obſerve to put two ſtrings to each ſide of the parchment, in order to take out the new worms upon their leaves, and to ſtir up the remaining eggs with the end of a quill, as well as to give freſh air to the box.

Some people uſe a piece of paper inſtead of parchment, but it is obvious that this laſt is a great deal preferable to the other; the paper attracting all the moiſture of the leaves, ſoon ſticks to the eggs, and makes them ſo cold as to prevent many worms from coming out.

If the hatching has been done on ſieves in the ſtove-room, you have nothing to do but to put the parchment over the eggs in the ſame way.

As ſoon as you perceive a ſufficient number of worms upon the leaves, by lifting up the parchment you carry thoſe leaves with the worms into a larger

box or ſhelf, paſted inſide and at the bottom with white paper ; you muſt obſerve not to fill up but about a third part of the bottom with your leaves ;* there you feed the young worms till after their firſt moulting.

After that firſt crop, you put the ſame parchment again upon the remaining eggs, with ſome other leaves over, and repeat the operation till the whole hatching is come out ; it is underſtood in the courſe of two days and no longer.

You will obſerve not to mix the worms collected the firſt day, with thoſe come out the ſecond ; thus by keeping apart the worms of the ſame age, you will avoid an irkſome trouble at the time of their getting upon the boughs to ſpin their ſilk.

13*th Que.* What degree of heat is neceſſary to the worms after their coming out ? which is the moſt proper leaf for them ?

Anſ. Provident nature takes care to cloath the ſilk worms for the firſt days of their life, with a kind of furred hairs, which go off before the third moulting ; that evinces enough the want of warmth ; thus we think it neceſſary to keep the worms in the ſame degree of heat for ten or twelve days after their coming out.

As to the age and the quality of the leaves fit to be given to the young worms, many writers entertain different opinions : but on that ſubject we muſt ſtick to nature, and adviſe you to give the tendereſt poſſible, whether thoſe of grafted or ungrafted, young or old trees.

You may depend only on this experienced fact, that the ſilk worms cannot live upon any other ſort of leaf but that of mulberry : though they may eat by way of paſtime ſome other leaves, like thoſe of

* Becauſe the worms growing bigger every day, could not find room enough if they were crowded into the box at firſt.

lettuce, roſe-oak, or elm, they could live as long without any food at all, and if they are deprived for ſeveral days of mulberry leaves, they muſt die.

14*th Que.* How many times a day ought the worms to be fed in the beginning?

Anſ. The moſt general cuſtom is, to feed the worms twice a day till they get in their firſt moulting, but we have found it better to feed them three times, obſerving not to give but few leaves at once, and take care that the firſt leaves ſhould be eaten before you give the other. By that way, you keep the worms in a more uniform ſtate of heat and cleanneſs, as by the change of leaves no unwholeſome dampneſs, nor any noxious vapors, have time to riſe from their food.

How many days they continue to eat from the moment they come out to that of the firſt moulting, is not to be determined preciſely: it depends in a great meaſure on the degree of heat, and the quality of the leaves; for example: If the weather is mild and favorable; if the worms are kept in the ſame degree of heat in which they came out; if the leaves are tender, dry, and free from froſt and burning winds, then the worms will arrive in ſix or ſeven days to their firſt moulting.

On the contrary, they will take more time in proportion to the circumſtances here pointed out, and when they do not arrive to that moulting in leſs than a fortnight, there is little hope of their doing well for the future: we have remarked in that caſe that they afford but an indifferent profit.

We have ſeen many people going to the trouble of mincing the leaves, in order (as they ſuppoſe) to make the worms eat the heartier, we found however it was to no purpoſe, and we mention it only to deter our readers from ſuch uſeleſs trials which may be recommended or heard of.

15*th Que.* Before you proceed further, pray what

is the nature of that moulting of ſilk worms? How many moultings do they undergo? Is there not a way to prevent worms from periſhing by that kind of diſorder?

Anſ. The moulting of ſilk worms, is a torpid and ſleepy ſtate, which cannot be called properly a diſorder, becauſe it is natural to them, and ſeems neceſſary to digeſt, by a preparatory action, all the glutinous particles deſtined for their future ſilk.

In that periodical revolution, worms want no food; they leave their old coat to get out with a new one. They undergo four moultings before they arrive to their ſpinning work: ſeveral die through theſe critical periods, but no remedy has been found yet, and we think it would be hurtful to attempt to accelerate even the courſe of that natural revolution. The only help is, to keep the worms a little warmer if poſſible, and particularly not to diſturb them.

16*th Que.* How is the time of the moultings to be known? What care is required after?

Anſ. A little before their moulting, the worms loſe their appetite; they look dull and weak; their ſkin becomes bright; they ſeek for a place to hide themſelves, under the leaves or in ſome corner of the ſhelf, always out of the way of other worms; there they remain motionleſs for about two days; their head becomes bigger and ſtands up; in the latter part of that time, their ſkin bends in wrinkles, and their body ſeems ſomewhat ſhortened. All theſe ſymptoms are better perceived in the three laſt moultings than in the firſt, according to the bigneſs of the worms.

It is not to be expected, that all the worms of one ſhelf will come to their moulting the ſame day; but if the greateſt part is come out in three or four days, which you may perceive by the colour of their ſkin as well as by their activity, then it is time to change their litter and clean the ſhelf. In order to get the worms out, you muſt ſpread over ſome freſh leaves,

upon which they will get ſoon, ſo as to enable you to lift them up from the ſhelf.

You muſt obſerve to proportion your ſhelves to the increaſe of the worms: for inſtance, after the firſt moulting, thoſe who were contained in one ſhelf, muſt be divided in two ſhelves of the ſame dimenſions, in order that they ſhould have ſufficient room. The ſame attention is neceſſary for their progreſſive growth at every other moulting.

17*th Que.* When the firſt moulting is over, how may we diſtinguiſh the worms that will do well, from thoſe that will not ſucceed, and are likely to periſh before they paſs through the other moultings? Out of the four moultings, which is the moſt dangerous?

Anſ. As ſoon as the worms come out, you may remark three different kinds, ſome of a reddiſh, ſome of an aſh, and ſome of a black hue. The reddiſh colour is reckoned the worſt, that kind of worm will never do well, and we know from unqueſtionable experience, that it is better to throw them away: the two other kinds will ſucceed and ſpin the beſt ſilk.

As to the moſt dangerous moulting, it has been reckoned always, that a greater number of worms periſh in the third; no reaſon can be aſſigned for it; the fact lays open to our obſervation, while the courſe of it remains hid, like a thouſand other ſecrets of nature.

18*th Que.* What time of the day do you chuſe to gather leaves for the feeding of your worms? How do you keep thoſe leaves?

Anſ. Avoid carefully the picking of the leaves in the morning, until three or four hours after ſunriſing, and only when they are free from dew or any dampneſs.

Before the firſt moulting, the worms require ſo little food, that it is eaſy to keep a few leaves in an earthen pot, covered with a bit of linen, and put in a dry cellar, or in any other part of the houſe, out of the heat of the ſun.

According to the number and ſize of your worms, if you want a great quantity of leaves every day, they muſt be kept in large tubs, or ſpread on the floor of a room, only open on the north ſide; then take care to ſtir or turn them over two or three times a day, according to the temperature, for fear they ſhould be heated or withered.

N. B. The number of meals after the firſt moulting, as well as the quantity of leaves to be given to your worms, muſt be regulated by their appetite: the beſt method is to feed them with few leaves at once, and to repeat it as many times, day and night, as they conſume the leaves of the former feeding.

If your worms are dull and without appetite, it is a certain ſign that they are in want of heat; then you muſt warm the room to the degree mentioned in our 6th query.

We obſerved that it was in vain to accumulate food for the worms as long as they were too cool, and deprived of appetite; too many leaves in that caſe make them cooler than before, and at laſt kill a great number of them.

19*th Que.* What is the interval betwixt the firſt moulting and the ſecond, betwixt the third and the fourth? Is it neceſſary to keep the worms warmer, in proportion as they grow bigger? How often ought their ſhelves to be cleaned?

Anſ. 1ſt. Suppoſing worms in good order and thriving, they will get into their ſecond moulting, ſeven or eight days after the firſt, and ſo on for the two other following.

2d. The bigger worms grow, the leſs they ſtand in want of heat: however, as long as they eat heartily, it would be needleſs to leſſen or to alter ſuddenly the degree of heat which they have been uſed to from their coming out. The only thing which we would recommend after the third moulting, is to open a window for a few hours in the day time, in order to introduce freſh air into the room.

3d. Provided no diſorder, nor too long interval has taken place betwixt one moulting and the other, the ſhelves want to be cleaned only once after every moulting; becauſe, you muſt carefully avoid diſturbing your worms. Notwithſtanding, if one ſhelf is too much crowded, you may take out as many worms as you think proper at the moment of a new meal, when they get on freſh leaves. Theſe inſects cannot bear to be touched, and it is common for them to die of the bruiſes received by the rude handling of perſons unaccuſtomed to them.

20*th Que.* Reſpecting the food of ſilk worms, is there a great difference betwixt the leaves of wild mulberries of this country, the red Engliſh mulberry and thoſe Italian trees which are called white mulberries?

Anſ. We make no doubt that ſilk worms could eat leaves of wild mulberries, and thoſe called red Engliſh mulberries; but experience teaches us, that the moſt proper food is the leaf of the white mulberry tree. Yet there is a difference betwixt leaves of the ungrafted white mulberry and thoſe of the grafted one; betwixt leaves of a young tree and thoſe of an old one: but for fear of being prolix in giving a full account of that difference, we ſhall only obſerve, that leaves of ungrafted and above all of young trees, are better adapted to the firſt age of ſilk worms, as far as their third moulting; after which, as they grow ſtronger, leaves of grafted or of old trees, being more ſubſtantial, will agree better with them for the remainder of their ſhort life.

They who may not have it in their power to chuſe the food of their worms according to the above inſtruction, ſhould nevertheleſs be by no means diſcouraged, ſince they will find a ſufficient reward in feeding them even upon one ſort of leaf, till time ſhould have made ſuch improvements, as can-

not be expected now that we are juſt beginning this branch of rural induſtry.

21*ſt Que.* You recommended in the 14th query, not to gather leaves but when dry; what then is to be done in rainy weather?

Anſ. It is well known that wet leaves are very hurtful to the worms, and ſuppoſing that the rain ſhould laſt more than twenty-four hours, (which is very ſeldom the caſe in the months of May and June) it would be neceſſary to dry leaves as well as poſſible upon ſome ſheets previouſly warmed for that purpoſe. As it requires a conſiderable time to dry the leaves, it is adviſable in caſe of a long and conſtant rain, to diminiſh the uſual quantity of food, till the firſt clear moment will allow the gathering of dry leaves again.

22*d Que.* Could not the ſilk worm feed upon leaves of ſome other tree?

Anſ. We can ſay in poſitive terms, that though many curious trials and attempts have been made to this effect, nothing has been found to ſerve as a ſubſtitute for mulberry leaves.

A fact well known, is worth our attention reſpecting the leaves of mulberry; they are as much the peculiar food of the ſilk-worm, as thoſe of other plants and trees are unfit for him; and we may aſſert with confidence, that the mulberry ſeems reſerved to the ſilk-worm alone, no other worm or caterpiller, whatever likeneſs they might have in their ſhape, habits, &c. to our ſilk-worms, ever feed upon mulberry leaves. Catterpillars may be ſeen by chance upon mulberries, but if you take the trouble to look attentively, you will perceive that they ſoon leave that place where they came by miſtake, or by a mere accidental wandering as they might have come upon a ſtone, &c.

23*d Que.* Is it neceſſary to keep the worms in darkneſs? Does a full light hurt them?

Anſ. It has been obſerved long ago, that the ſilk-worm is inclined to avoid a bright light. Many naturaliſts conſider him as a nocturnal inſect. You may remark as a proof of it, that ſilk-worms are eager to conceal themſelves under leaves in the day time, and when there is any diſorder in a worm's houſe, you will find many more of them ſick in places moſt expoſed to the light than any where elſe. Therefore we adviſe to ſhut up the windows of the room in the day-time, or in caſe the weather ſhould be too hot, to hang up brown or green curtains, and let them open in the night.

24*th Que.* Is heat more noxious to ſilk-worms thank cold?

A. The difference is ſuch, that a great heat makes worms lazy, dejected, and without appetite. An exceſſive heat happening at the time of their getting up to ſpin, is apt to choak the greateſt part of them. On the other hand, a cold, ſuch as happens in the month of May, ſometimes puts the worms a little back, but it never injures them ſo much as the heat above the degree before mentioned.

Then we may judge that worms do better in dry weather, with a northerly wind, than in damp weather, with a ſoutherly wind, or during a dead calm. In this laſt ſituation, it is good to make ſome light fire in their room, in order to rarify the air, provided the room is well opened, and the fire ſhould not laſt longer than about half an hour.

25*th Que.* How long do the worms remain feeding upon the mulberry leaves, before they begin to ſpin?

Anſ. Being over his laſt moulting, the worm eats voraciouſly, and wants a great deal more food than before. At the end of ſeven or eight days, he begins his cocoon; in that ſhort interval it is very neceſſary to clean the ſhelves every day, and procure as much pure air as the weather will permit.

26*th Que.* How may it be known that the worm is mature and ready to ſpin ?

Anſ. When you perceive him creeping upon the leaves without biting them, but keeping his head up and turning it in different directions, as if he was looking for a place fit to faſten his cocoon on when he tries to get off the ſhelf; when his body is become tranſparent and bright, and like the colour of ſtraw ; then it is high time to have ſome heath or other thin buſhes fixed beforehand upon tables.

27*th Que.* Do you fix thoſe buſhes or boughs with their leaves on ?

Anſ. Thoſe buſhes or boughs muſt be dry and well cleared of all their leaves. The beſt way is to fix them upon tables, in double rows, ſo as to make a kind of arched form betwixt the extremity of the twigs. At the foot of the boughs it will not be uſeleſs to put ſome thinner branches of birch tree or ſome clean ſhavings, in order to facilitate the getting up of the worm. Great care muſt be taken not to put too many worms on the ſame place.

28*th Que.* Notwithſtanding all your care and ſkill, when worms are carried on the boughs, there may be ſome amongſt them who want ſtill to be fed for one or two days : in that caſe what is to be done ?

Anſ. It is true that ſome of them want feeding yet, after they have been brought on the bough-table ; then we muſt give them leaves on that table, and feed them ſo till they get up by themſelves on the boughs.

29*th Que.* How can the worms be carried and placed upon the bough-table without hurting them ?

Anſ. From the ſymptoms given in our 27th query, when you know that your worms are mature, you preſent them your finger, to which they readily attach themſelves ; but as it would be too long and tedious to carry them all one after the other,

you depoſit as many as you can upon a varniſhed plate, to which they cannot ſtick faſt, and you carry them all at once upon a bough-table. It will be eaſy to diſtinguiſh thoſe who want to be fed yet; becauſe they lay on the table, and refuſe to get up on the bough.

30*th Que.* How many days does the ſilk worm employ in the ſpinning, and what is the time to pick up the cocoon?

Anſ. The worm's ſpinning is completed in three or four days; but as among a great number, they do not ſpin all at the ſame time—the beſt method is to pick up the cocoons twelve days after the firſt worms have begun their ſpinning.

31*ſt Que.* Is it neceſſary to kill the worms in their cocoons? When and how?

Anſ. If you cannot draw the ſilk ſoon after the picking up of cocoons, it is indiſpenſible to choak the chryſalis contained in each cocoon, otherwiſe that chryſalis would ſoon become a butterfly, and by boring its way through the cocoon, break the contexture of the ſilk. Therefore, after you have choſen and ſet apart the beſt cocoons intended for eggs or ſeed, as mentioned in the 4th query, you muſt take off the upper part of your other cocoons, which is called the downy tow, and which is quite ſeparate from the ſilk; you put the cocoons in large baſkets, furniſhed on the inſide with a coarſe brown paper: when the oven is heated at the common degree for baking bread, you may put the baſkets into it, and leave them there about two hours, till you hear no more the rattling noiſe of the inſects, as they move and ſtir about on account of the heat which they feel during that time.

Take care afterwards to wrap up thoſe cocoons in a blanket, in order to kill entirely thoſe who ſhould not have been choaked by the heat of the oven.

32*d Que.* How to manage the cocoons intended for eggs?

Anſ. We forgot to mention before, that in the choice of cocoons, particular care muſt be taken to reſerve an equal number of males and females. The male cocoon is ſharp pointed, while the female is round at both ends. This choice made, the cocoons ought to be diveſted of that downy cover heretofore mentioned. Then you ſtring them together, males and females alternately upon a coarſe thread; but you muſt take care that the needle ſhould not go further than into the ſurface of the cocoon, in order not to hurt the chryſalides, nor to open any way to the air; hang this ſtring of cocoons in a dry and airy place till the butterfly comes out.

Upon a common average, one pound of cocoons will produce one ounce of eggs.

33*d Que.* When chryſalides come out of the cocoons under the form of butterflies, how are the males to be diſtinguiſhed from the females? Is it neceſſary to help their copulation?

Anſ. It is very eaſy to diſtinguiſh the males from the females: the firſt *are ſmall, ſharp pointed,* and more active, the laſt being full of eggs, are bigger, heavier and round.

As to the ſecond part of this query, we may ſay that art in this caſe ought to concur with nature. As theſe butterflies are very heavy, and live but few days, there is no doubt that many females would lay their eggs without meeting with males; therefore, it is neceſſary to take the lazy males by their wings, as gently as poſſible, in order to carry them to the females upon a bit of black cloth: let them be united for about four hours, afterwards throw away the males, and leave the females only till they have laid their eggs.

Theſe eggs ought to be expoſed to the air two or three days, in order to dry them; after which, roll

them up upon the cloth, put them in a freſh room during the ſummer, and out of the reach of the froſt in the winter.

34*th Qye.* Beſides the four moultings of ſilk worms which may be looked upon as a kind of natural diſeaſe, are they not liable to ſome other diſorder?

Anſ. Generally ſpeaking, careleſſneſs, neglect or want of ſkill in raiſing room ſilk worms, bring upon them the greateſt part of their diſorders; however it is neceſſary to be acquainted with thoſe different diſorders.

1ſt. Some worms turn fat, and are eaſily diſcovered in the time of every moulting, becauſe they never undergo that natural change peculiar to the good worms, as ſtated in our 15th query. The fat worms inſtead of remaining ſtill or motionleſs in the time of moulting, are moving about and eating; they continue to grow and are eaſily diſtinguiſhed, being a great deal whiter and looking oily; they muſt be thrown away for fear they ſhould ſpoil the other: beſides, as they periſh ſooner or later, it would be an uſeleſs trouble to feed them longer.

2d. This ſecond diſorder is quite the reverſe of the firſt. After the third or fourth moulting, ſome worms become lean, they refuſe to eat; then turning ſoft, ſmaller and ſhorter by half than they were before: they muſt die in the courſe of three or four days, as in a conſumption.

3d. The yellow worms never appear but a little before the time of ſpinning: inſtead of becoming mature, they ſwell up, and you may perceive ſeveral naſty yellowiſh ſpots, on their head firſt, and ſoon after ſpreading all over their body: they muſt be thrown away.

It is eaſier to deſcribe thoſe diſorders, than to point out the remedy: and indeed, after many expenſive trials, it has been found more advantageous to throw away worms taken by one of theſe diſorders, than

to let them contaminate the others, as every attempt to cure them fell ſhort of ſucceſs.*

PART II.

On the Raiſing of Silk Worms, in open Air, upon Hedges. By PETER DE LA BIGARRE, *Eſq.*

AFTER a long and tedious deſcription of the various cares and expences attending the beſt mode of raiſing ſilk worms, within doors, we feel an agreeable relaxation in relinquiſhing art, to come into the arms of nature. Let us play with her eaſy ways; let us admire how little trouble is required to obtain plenteous favors from her rich boſom!

The firſt ſtep is to have a white mulberry hedge, three years old at leaſt, and four or five feet high. For the mode of planting ſuch an hedge, we would have referred our readers to a communication made to the agricultural ſociety of New-York, *on the utility of white mulberry trees in making hedges;* but conſidering the trouble of getting that communication among ſo many other pieces preſented to the ſociety, we thought it preferable to give here an extract of it, with ſome neceſſary additions.

Around the field to be encloſed, dig a ditch three

* Since the deſcription of the above mentioned diſorders, I was favored with information of an experiment made in this ſtate, by which it appears that this climate is more friendly to the ſilk worm, than that of Spain or France. Out of 6000 worms raiſed by Mrs. Montgomery, very few died in the courſe of their education; and it is worth while to obſerve, that no greater loſs happened in the preceding years. Therefore, what an immenſe advantage have we over Europe in raiſing of ſilk worms, where (upon a common average) four fifths of the worms periſh before their ſpinning!

What powerful encouragement to you, happy people of this country, when certain of obtaining complete ſucceſs, you may reap in the courſe of ſix weeks ſuch an affluent crop! Oh bleſſed land! Oh ten times fortunate Americans, could they but know and improve their natural and local advantages!

feet wide and two feet deep, in the fall of the year: then in the month of March or in the beginning of April, as ſoon as the froſt is out of the ground, give a light hoeing to the bottom of your trench. The longeſt roots of your plants being cut off near the hairy fibres, they muſt be planted about eighteen inches deep, at the diſtance of three or four inches from each other; after the trench is filled up, every ſhoot muſt be cut at the height of two or three inches above the ground; whether the plant is big or not, is no matter, provided it is at leaſt one year old; obſerve only to give the preference to the white mulberry as the food of ſilk worms.

The ſecond year it is neceſſary to cut again the ſhoots about ſix inches above the ground, in order to give more ſtrength to the ſprouting branches, which will form a pretty ſtrong hedge the third year, and at laſt grow ſo thick as to be impaſſable for any cattle: it may be twiſted and interwoven a great deal eaſier than the hawthorn. If you chuſe to make a ſtronger hedge, you may plant it in a double row.

Since this communication was written, we are happy in informing our readers, that laſt March, after the planting a mulberry hedge according to the above directions, we ſtuck along ſide of it ſome remaining ſlips of our plants to form a double row: and though theſe ſlips had been thrown away and laid out of the ground for ten days before we thought of making that trial, we perceived with a pleaſing ſurpriſe, that the greateſt part were putting forth leaves, and are now actually growing as well as the rooted plants themſelves.

Therefore, ſuch a ſaving, will make the planting of white mulberry hedges, if not cheaper, at leaſt as cheap as thoſe of any other wood, if we except only the willow tree. Then from this already acquired improvement, you may make your hedges as ſtrong as you pleaſe.

At any time or at any age of your hedges, if ſome place become vacant, or feeble, you can eaſily replace it with a few ſlips.

For three years the young hedge muſt be defended againſt the cattle by a proper fence, like every other plantation of the kind; the ground muſt be worked and kept clear from weeds every year after. It is neceſſary to keep conſtantly the hedge at the height of four or five feet, as the moſt proper for the raiſing of ſilk worms.

No wood grows quicker than the mulberry tree; you may remark that after the firſt leaves have been employed in the ſpring to feed the ſilk worm: the other leaves of the fall may be gathered, and when dry, they afford a good fodder for cattle.

The objection will be, the difficulty of getting thoſe young mulberry plants to make hedges with. They muſt be bought in ſome particular nurſeries like thoſe in New-Jerſey, upon Long-Iſland, &c. However, any farmer not wiſhing to go to that expence, may eaſily raiſe the plants from ſeeds, in the following way:—

Gather all the ripe berries fallen down under the white mulberry tree, put them for two days in a dry place, where they muſt be turned up and down for fear they ſhould be heated. After which you muſt waſh them with your hands in a tub, pouring over ſome water from time to time, in order to ſeparate the ſeeds from the muſt. Let then the water ſettle for a quarter of an hour, and all the uſeleſs particles floating above may be poured off. You muſt repeat the above waſhing till the ſeed is well diſengaged and pure. The beſt ſeed being the heavieſt, will always ſtay at the bottom of the tub. This being done, ſpread all the good ſeeds to dry upon a bit of linen; when dry, keep them in a cloſet till the proper ſeaſon for ſowing. Obſerve, that this kind of ſeed never keeps longer than one year. The beſt time to ſow the mulberry is in the beginning of April.

Some people pretend that the ſeeds grow very well when ſowed in the very trench made for the hedge, but a long experience teaches us, that it is better to raiſe the plants in a nurſery where the ground is rich and well manured: you will chooſe for the purpoſe, a place ſheltered from the north and cold winds; that place muſt be digged and prepared before the winter. The beſt way is to make a bed four feet wide only, in order to be able to water it and pick the weeds out, without trampling upon the ſeed's-bed. Before you water the ſeeds, you muſt ſpread over ſome light ſtraw to prevent the ground from becoming too hard, which otherwiſe would be an obſtacle to the raiſing up of the young plants.

The plants are fit to be tranſplanted the following year, in the trenches intended for hedges, after the manner and at the time above mentioned. The mulberry grows in every ſoil, but it delights in a rich ſandy ground.

(1ſt. Que.) What is the moſt proper hedge to feed the ſilk worms upon?

(Anſ.) An hedge three years old begins to be fit for the worms; but we muſt own, that one or two years older, will produce more leaves of a ſtronger ſubſtance and affords a ſtronger ſhelter for theſe inſects. The thickneſs of the hedge is a great advantage to the ſilk worm, in rainy or boiſterous weather; beſides, they climb upon branches well interwoven, they hide themſelves better and reſt more ſecured, than upon rare and thin branches.

(2d Que.) Do you put the eggs or the worms already come out, upon the leaves of the hedge, and how?

(Anſ.) It is obvious, that the eggs ſhould never be hatched in open air when we know that the hatch requires an equal and conſtant degree of heat, even at home. Therefore you muſt follow the directions mentioned in the firſt part, as well for the choice of

the eggs as for their hatching; beſides, you muſt not expect that the young worms could be put on the hedge before two or three days after the firſt moulting; then chuſe mild weather, and as fine a day as poſſible, to take your worms upon ſome leaves as directed in the 20th query of the firſt part, and in that way, carry and put them on the freſh leaves of the hedge, taking care not to ſpread them too thick; about one hundred will be ſufficient for the ſpace of thirty feet in length, if the hedge is young yet and thin, but more in proportion to the age or to the thickneſs of your hedge.

(3d Que.) If your ſilk worms upon hedges are not attacked by other inſects, will not they be picked up by the birds which are in ſuch great numbers in this country?

(Anſ.) Though we have not remarked that birds are fond of our ſilk worms, we are ſatisfied that they may be eaſily defended againſt them. Suppoſing that among ſuch a variety of birds, ſome are deſtructive of our worms; then you may ſpread an old net over the hedge, or fix ſome rows of twine all along with a few pieces of rags at proper diſtances: any kind of ſcare-crow will keep the birds away. It is eſpecially neceſſary, to overlook the hedge before you put on your worms, in order to deſtroy all the neſts, or rather not ſuffer any bird to ſet his neſt on in the beginning of the ſpring. By that little and unexpenſive attention, you will not be injured by the birds.

(4th Que.) Are worms raiſed upon the hedges, liable to the diſorders common to thoſe raiſed within doors? And what care or attendance do they require after being put on the hedges?

Anſ. It is proved by experience and beyond any doubt, that worms raiſed in open air are free from every diſorder; their only fate depends upon the

ſeaſon: but as the temperature from the fifteenth of May to the fifteenth of July, is a great deal finer and more moderate here than in Europe; above all, as we have very few inſtances of ſhowers of hail, which are ſo frequent and ſo deſtructive in other countries, we remain perfectly ſatisfied, that ſilk worms will ſucceed and thrive beyond our expectations in this bleſſed part of the world. Therefore, as ſoon as they can be ſecured againſt the voraciouſneſs of certain birds, you may leave them to the bountiful hand of nature; you need not afterwards take any more care, they muſt do, and they will *do* very well for themſelves.

The only thing which you have to do, is to enjoy the pleaſure of paying them a viſit from time to time. Like the happy farmer contemplating his promiſing harveſt, you will look at the growth and progreſs of your induſtrious worms; you will watch the time when they will have completed their ſpinning—Is it done? Come and collect, with a thankful hand, the cocoons hanging on the twigs of your hedge, like the golden fruit of the Heſperian garden.

END OF THE FIRST VOLUME.